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DEVELOPMENTOF WATER-EFFECTS RATIOS FOR COPPER AND ZINC VAN BUREN MUNICIPAL UTILITIES NORTH TREATMENT PLANT NPDES PERMIT NO. AR0040967

JANUARY 26, 2015

DEVELOPMENT OF WATER-EFFECTS
RATIOS FOR COPPER AND ZINC
VAN BUREN MUNICIPAL UTILITIES
NORTH TREATMENT PLANT
NPDES PERMIT NO. AR0040967

Prepared for

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1.0 INTRODUCTION

The purpose of this document is to present the results of water effects ratio (WER) development for copper (Cu) and zinc (Zn) for the Van Buren North Treatment Plant, Van Buren Municipal Utilities (VBMU)(National Pollutant Discharge Elimination System (NPDES) Permit No. AR0040967).The objective of this study is to develop WERs to support a site-specific modification of the water quality criteria for Cu and Zn in the reach of Lee Creek downstream of the North Plant Outfall 001.

1.1 Discharge Characteristics, Effluent Monitoring and Permit Compliance

Permit limits for the existing NPDES permit are provided in Table 1.1. The discharge occasionally exceeds NPDES permit limits for Cu and Zn. The existing Cu and Zn limits are based on the state's water quality criteria (APCEC 2011), based on the national criteria.

Under the present permit (effective March 1, 2008) for VBMU, there have been seven episodes of whole effluent toxicity (WET) in routine biomonitoring. Testing conducted during late 2013 and early2014 indicated sufficient levels and frequency of lethal toxicity to require a toxicity reduction evaluation (TRE). As of this writing, the TRE project has not identified the cause(s) of toxicity. Prior to the episodes of toxicity, the facility was in the process of developing WERs for Cu and Zn to address the exceedances of limitations for these metals in the discharge. Episodes of WET that are due to Cu or Zn concentrations will preclude the possibility of development of WERs for Cu and Zn because the primary justification for implementing the WERs is that Cu and/or Zn do not cause toxicity in the discharge. Accordingly, available WET and analytical data were examined to evaluate whether or not observed levels and patterns of toxicity were consistent with levels and patterns of Cu and Zn concentrations. This evaluation, which is provided in detail in Appendix A, demonstrates that episodes of toxicity in routine biomonitoring at Outfall 001 are not due to the presence of Cu or Zn in toxic concentrations. Therefore, episodes of toxicity up to this point should not preclude development or implementation of a WER.

Table 1.1 Current NPDES permit discharge limits for Van Buren North Treatment Plant Outfall 001.

Effluent Characteristics	**Discharge Limitations (mg/L, unless otherwise specified)**	
	Monthly Average	**7-day Average**
Flow	N/A	Report
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)		
May – October	10.0	15.0
November – April	20.0	30.0
Total Suspended Solids (TSS)		
May – October	15.0	22.5
November – April	20.0	30.0
Ammonia Nitrogen		
April	2.2	5.6
May – October	2.0	3.0
November – March	4.0	6.0
Dissolved Oxygen		
May – October	5.0 (Monthly Average Minimum)	
November – April	6.0 (Monthly Average Minimum)	
Fecal Coliform Bacteria (FCB)		
April – September	200 colony-forming units (CFU)/100mL	400 CFU/100mL
October – March	1,000 CFU/100mL	2,000 CFU/100mL
Copper, Total Recoverable	9.2 µg/L	18.5 µg/L
Zinc, Total Recoverable	85.5 µg/L	171.6 µg/L
pH	Minimum: 6.0 su	Maximum: 9.0 su
***Pimephalespromelas* (Chronic)**	**7-day Average**	
Pass/Fail Lethality (7-day NOEC)	Report (Pass/Fail)	
Pass/Fail Growth (7-day NOEC)	Report (Pass/Fail)	
Survival (7-day NOEC)	Report %	
Coefficient of Variation	Report %	
Reproduction (7-day NOEC)	Report %	
***Ceriodaphnia dubia* (Chronic)**	**7-day Average**	
Pass/Fail Lethality (7-day NOEC)	Report (Pass/Fail)	
Pass/Fail Growth (7-day NOEC)	Report (Pass/Fail)	
Survival (7-day NOEC)	Report %	
Coefficient of Variation	Report %	
Reproduction (7-day NOEC)	Report %	

A summary of exceedance factors (measured Cu or Zn concentration ÷ permit limit) for recent (January 2012 through September 2014) routine monitoring data is presented in Table 1.2. The 95th percentile values for the exceedance factors corresponding to the monthly average are 2.05 and 1.58 for Cu and Zn respectively. This result indicates that the existing monthly average permit limits for Cu and Zn need to be increased by a factor of approximately 2.0 and 1.6, respectively, to result in permit compliance.

1.2 Sources of Cu and Zn

A pretreatment audit conducted by the Arkansas Department of Environmental Quality (ADEQ) June 19 - 21, 2012, observed that the North Plant has only one significant industrial user (Truck Wash of America) which was eliminated as a possible source of Cu and Zn. The audit concluded that Cu and Zn in the effluent appear to originate from domestic sources. The ADEQ audit report (Appendix B) recommended that the City consider developing a WER for Cu and Zn.

1.3 Technical Approach

Information presented in the preceding sections indicates the following:

1. Cu and Zn concentration exceed effluent limitations,
2. The discharge is in general compliance with its permit on other parameters,
3. Episodes of toxicity are not attributable to elevated Cu or Zn concentrations,
4. Metals (i.e., Cu and Zn) are primarily due to domestic sources, and
5. Development of a WER is a viable option for meeting permit limits.

Table 1.2. Summary of zinc and copper concentrations and exceedance factors based on Outfall 001 monitoring from January 2012 through September 2014.

Summary Statistic		Copper		Zinc	
		Concentration	Exceedance Factor	Concentration	Exceedance Factor
Percentile	95	17.00	2.05	140	1.58
	75	11.00	1.33	98.0	1.11
	50	8.35	1.01	82.0	0.93
	25	6.73	0.81	65.0	0.74
Minimum		2.10	0.25	39.0	0.44
Average		9.61	1.16	93.12	1.05
Maximum		38	4.59	560	6.33
Proportion Exceedance Factors > 1.0			0.51		0.36

1.3.1 Work Plans

FTN prepared separate work plans for the Cu and Zn WER development that provided the technical approach to conduct the WER studies. The work plans for the Cu and Zn WERs were submitted to the ADEQ on 2/5/2013 and 3/4/2013, respectively. These work plans are provided in Appendices C and D. Over 1 year following the submittal of the work plans, written comments were received from ADEQ (2/26/2014) and the Environmental Protection Agency (EPA) (6/13/2014). The EPA comments (provided in Appendix E)[1] requested the following additional definitive tests:

1. A test conducted when elevated flows are present in Lee Creek due to a rainfall event with the effluent and upstream water mixed at the ratio of the flows that exist when the samples are taken.
2. A test conducted in 100% effluent spiked with both Cu and Zn at the proposed criteria levels (i.e., the criteria multiplied by the respective WERs). A demonstration that toxicity does not exist at the metal concentration represented by both metals being present at the proposed criteria levels being necessary to support the proposed criteria.

[1] ADEQ provided its comments directly on the electronic copies of the work plan and are not provided herein. The ADEQ comments did not request any changes in the technical approach proposed in the study plans.

1.3.2 Technical Approach: Copper

The Cu WER plan was based on EPA's Streamlined Procedure (EPA 2001) which applies only to situations where Cu concentrations are elevated primarily by continuous point sources and where Cu in the receiving stream is expected to attain its maximum concentrations under low-flow conditions. The Streamlined Procedure is not intended for situations where the Cu sources are dominated by wet weather or nonpoint sources (EPA 2001). Since Lee Creek is not on the 303(d) list of impaired waters it was presumed that Lee Creek is meeting water quality standards for Cu and Zn and that Outfall 001 represents the major source of Cu in the reach of Lee Creek in question. Accordingly, the Streamlined Procedure provided an appropriate approach for WER development for Cu.

The WER calculation for each test involves comparing the water site LC50s and the greater of the LC50 of the laboratory water or the Species Mean Acute Value (SMAV) given in Appendix B of EPA (2001). For purposes of WER calculations, the site water LC50s were normalized to the hardness of the laboratory water, or the SMAV as appropriate, using the following formula[2]:

Formula 1.1.

$$LC50_{\text{at Lab Hdns}} = LC50_{\text{at Sample Hdns}} \left[\frac{\text{Lab Hdns}}{\text{Sample Hdns}} \right]^{S}$$

Where: **$LC50_{\text{at Lab Hdns}}$** = LC50 of site water (effluent or simulated downstream sample) normalized to lab water hardness,

$LC50_{\text{at Sample Hdns}}$ = LC50 of effluent test or simulated downstream sample test,

Lab Hdns = hardness of water used in laboratory water test,

Sample Hdns = hardness of effluent or simulated downstream sample, and

S = the log-log slope of the hardness regression for Cu = 0.9422 per Appendix B of EPA (2001).

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[2] This formula is algebraically equivalent to LC50at lab hardness = LC50 at sample hardness$\{e^{s[\ln(\text{sample hardness})-\ln(\text{lab hardness})]}\}$ given in EPA 1997.

For each sample collected for Cu WER determination, the following metal-spiked sample matrices were tested concurrently:

1. Laboratory water prepared per EPA (1991), and
2. 100% effluent.

1.3.3 Technical Approach: Zinc

Technical guidance for conducting a WER study is provided in EPA's Interim Procedure (EPA 1994), which applies to most metals. Accordingly, WER testing for Van Buren was conducted according to EPA (1994).The approach used "Method 1" in EPA (1994). This method can be used to determine a WER in the vicinity of a plume or in receiving streams with zero flow (EPA 1994). The critical flow for Outfall 001 is 100%. Therefore, effluent samples were not mixed with water collected from the receiving stream.

For each sample collected for Zn WER determination, the metal-spiked sample matrices list below were tested concurrently. In EPA (1994) this test design is referred to a "Type 1 WER".

1. Laboratory water prepared per EPA (1991), and
2. 100% effluent.

To compare the laboratory water and site water LC50s (i.e., the simulated downstream mixture) for purposes of WER calculations, the site water LC50s were normalized to the hardness of the laboratory water using the same formula as above[3].

1.4 Additional Testing

In their comments on the work plans EPA requested two additional tests. One was to involve a test conducted when elevated flows are present in Lee Creek due to a rainfall event with the effluent and upstream water to be mixed at the ratio of the flows that exist when the samples are taken. In EPA (1994) this test design is referred to as a Type 2 WER.

[3] The slope(s) used for the hardness adjustment was 0.8473 per EPA (1997).

The second was a test conducted in 100% effluent spiked with both Cu and Zn at the proposed criteria levels (i.e., the criteria multiplied by the respective WERs). A demonstration of no toxicity at the metal concentration that represented both metals present at the proposed criteria levels is necessary to support the proposed criteria.

2.0 METHODS

2.1 Test Organisms

All toxicity tests and associated chemical analyses were conducted by American Interplex Corp. (AIC; 8600 Kanis Rd., Little Rock, AR 72204) which is certified for the required analyses by ADEQ.

Toxicity tests for Cu tests were conducted using *Ceriodaphnia dubia* cultured in laboratory water with a hardness of 100 mg/L. Test organisms were < 24 hours of age and within 8 hours of the same age at the beginning of the test. Test organisms were fed algae before being transferred to the test chambers to begin the test. However, no food was placed in the test containers, and special care was taken to prevent the transfer of food to the test containers along with the test organisms when the test was loaded.

C. dubia and *Pimephales promelas* were used for Zn testing. These test organisms are used for VBMU's routine biomonitoring, and their use for WER determination is consistent with recommendations in Appendix I of EPA (1994). *P. promelas* used in testing were 1 to 24 hours of age at the beginning of the test. Test organisms were hatched in laboratory dilution water and were not fed before or during the test.

2.2 Sample Collection

The site water sample used for testing was a 24-hour composite sample of effluent. Samples used for toxicity testing were maintained unpreserved at 1º to 4º C during collection, shipment and storage. Upon arrival to the laboratory, sub-samples of the composite were collected for analysis of chemical parameters using appropriate sample containers preservation. Samples for toxicity testing were stored in the dark at 1º to 4º C with no headspace in the container.

The effluent samples were collected at a time when the treatment plant operating conditions were average or better and the discharge was relatively unaffected by short-term perturbations due to rainfall. Normal operating conditions were documented based on measurements of biochemical oxygen demand (BOD), total suspended solids (TSS), ammonia, and flows compared to routine DMR monitoring results. Sample delivery to the testing laboratory included completed chain-of-custody (COC) documentation.

The receiving stream sample for the third definitive test, which was a Type 2 WER test, was collected as a grab sample from the surface of Lee Creek Reservoir near the spillway.

2.3 Laboratory Dilution and Culture Water

Water used in the laboratory water toxicity tests was prepared per EPA (1991) with total organic carbon (TOC) and TSS concentrations of < 0.5 mg/L and < 4 mg/L, respectively. The average effluent hardness from routine biomonitoring tests conducted from January 2011 through February 2013 was 68 mg/L (as $CaCO_3$). Accordingly, moderately hard water (MHW), which can be expected to have a hardness of 60 – 80 mg/L, was chosen for the tests using laboratory water and effluent. This procedure provided laboratory water with levels of alkalinity and pH appropriate for the level of hardness, and a measured hardness concentration between 40 and 220 mg/L, per EPA requirements (EPA 2001).

2.4 Range-Finding Tests

The purpose of the range-finding tests was to determine the appropriate range of metal (Cu or Zn) concentrations for the definitive tests, evaluate the need for test solution renewals at 24 hours and provide a preliminary estimate of the WER. A 1,000-mg/L (as Cu or Zn) stock solution used to spike the effluent and laboratory water was prepared from deionized water and reagent-grade Cu sulfate 5-hydrate ($CuSO_4(5H_2O)$) or Zn chloride ($ZnCl_2$), as appropriate. This stock solution was sufficiently concentrated to prevent significant dilution of the effluent or laboratory water with the deionized water matrix. The stock solution was also sufficiently acidified with reagent-grade acid to prevent metal precipitation during storage while not containing excess acid that would affect the pH of the test solutions.

The test was a 48-hour static non-renewal test using 20 organisms per concentration (four replicates of five organisms each) and seven metal exposure concentrations, including the unspiked effluent sample. Because the purpose of the range-finding test is to determine the appropriate upper and lower range of concentration for the definitive test, a dilution factor of 0.5

was used. Initial and final metal concentrations (total and dissolved) were measured at selected exposure concentrations.

2.5 Definitive Tests (Type 1 WERs)

Definitive toxicity tests to be used for the calculation of the WER were designed based on the results of the range-finding tests. A dilution factor of 0.6 was used to establish the Cu concentrations in successive test exposures in the definitive tests using *C. dubia* (EPA 2001). Per EPA (2001) the effluent-receiving stream mixture used in testing is to reflect the critical dilution as specified in the NPDES permit. NPDES AR0040967 specifies a critical dilution of 100%. Accordingly, the metal-spiked effluent test was conducted using undiluted effluent.

A dilution factor of 0.65 was used to establish the Zn concentrations in successive test exposures in the definitive tests using *C. dubia* and *P. promelas* (EPA 1994). Per Method 1 WER determination (EPA1994) the metal-spiked effluent test was conducted using undiluted effluent.

Definitive tests began within 96 hours of sample collection per EPA (2001) and EPA (1994). Exposure solutions were prepared by preparing a large volume of the highest test concentration of effluent or laboratory water. Serial dilutions of the spiked effluent and laboratory water were prepared using unspiked portions of the effluent and laboratory water, respectively. The same stock solutions were used to spike both effluent and laboratory water samples. The mixed solutions were then allowed to equilibrate at test temperature for 1 to 4 hours.

After the equilibration period, appropriate volumes (25 mL) of exposure solution were dispensed into the test chambers. Test organisms were assigned impartially to the test chambers. Five test chambers, each containing five organisms, were used for both the effluent and laboratory water tests. One of the chambers was used as a "chemistry control" for taking in situ measurements of dissolved oxygen, temperature, pH and specific conductance. In situ measurements were taken beginning at the lowest and ending at the highest concentration. Test organisms for both the effluent and the laboratory tests were added at the same time (within 0.5 hour). The two tests (effluent and laboratory water) were then conducted so that there were no differences other than the composition of the dilution water and the metal concentrations.

Tests were maintained and test organism effects/symptoms were observed and recorded as specified in EPA (1991). Direct in situ temperature measurements in test exposures were not taken during the toxicity tests. AIC maintains tests in incubation chambers that maintain a constant ambient temperature of 25 ± 1ºC that is continuously monitored.

Aliquots of the test solutions were retained for the analysis of total and dissolved metals at the beginning and end of the test as described below.

2.6 Additional Testing

2.6.1 Mixture of Effluent and Receiving Stream (Type 2 WER)

The reach of Lee Creek that receives the plant effluent is downstream of Lee Creek Reservoir. Although the receiving stream elevation is often the same as the normal water pool of the Arkansas River resulting in backwater conditions in Lee Creek, this evaluation assumed that surface water of the Lee Creek Reservoir generally represents downstream conditions. Therefore, the upstream water to be used for the test was collected from the surface of Lee Creek Reservoir near the spillway without regard to rainfall events. The effluent + receiving stream mix used in testing was based on the median flows recorded at US Geological Survey (USGS) gaging station at Lee Creek Dam (USGS 07250085) using the median flow of 95 cfs for the period of record (POR) from October 1, 1993 up to the day of sampling (July 27, 2014). The target percent effluent for the effluent + receiving stream mix was based on the average plant flow during the day of sampling and the preceding 2 days and the median flow recorded at USGS gaging station at Lee Creek Dam (USGS 07250085) for POR from October 1, 1993 up to the day of sampling (July 27, 2014). The average effluent and median Lee Creek flows were 1.14 cfs and 95 cfs, respectively. Therefore, the mixture of effluent + receiving stream for this test was 100 x 1.14/95 = 1.2%. This effluent mixture was spiked with Zn in a range finding and definitive test using *C. dubia* as described above.

2.6.2 Effluent with Copper and Zinc Added at Proposed Permit Concentrations

The WER values derived from the testing described and presented herein were 2.0 and 1.5 for Cu and Zn, respectively. The current acute criteria for Lee Creek, which provides the basis for the current weekly average permit limits are 10.99 µg/L and 96.81 µg/L for Cu and Zn, respectively. Accordingly the target Cu and Zn concentrations for the "combined metal" test were 2.0 x 10.99µg/L = 21.98 µg/L for Cu and 1.5 x 96.81 µg/L = 145.25 µg/L for Zn. To conduct this combined metal test an effluent sample was collected as described above and immediately analyzed for total Cu and Zn. The amount of additional Cu and Zn needed to add to the effluent to produce the target concentrations was then calculated based on the concentrations of Cu and Zn already present. A series of five test exposures was then prepared such that the metal concentrations of the middle exposure equaled (within analytical error) the target concentrations given above and all five successive exposures differed by a factor of 0.75.

2.7 Chemical and Other Measurements

Effluent samples collected for each series of tests (including range-finding tests and definitive tests) were analyzed for the parameters listed in Table 2.1. The effluent analysis included parameters needed to perform biotic ligand model (BLM) calculations (EPA 2007). Samples for the analysis of Cu and/or Zn were collected from each concentration at the beginning and end of the 48-hour test period. The sample for a particular test concentration at the end of the test was collected by combining all four replicates into a single composite. A portion of the composite was then filtered through a 0.45-µm pore-size membrane filter. The preserved samples were then analyzed as a single batch at the end of the test. Analyses were conducted on all test concentrations.

Table 2.1. Analytical parameters for effluent samples to be collected for WER testing.

Parameter	Analytical Method	Reporting Limit (mg/L)
Total Recoverable Cu *	EPA 200.8	0.001
Dissolved Cu *	EPA 200.8	0.001
Total Recoverable Zn	EPA 200.8	0.002
Dissolved Zn	EPA 200.8	0.002
CBOD-5	EPA 405.1	2
TSS	EPA 160.3	4
TOC	EPA 415.1	1.0
DOC	EPA 415.1	1.0
Total Calcium	EPA 200.8	0.1
Total Magnesium	EPA 200.8	0.03
Total Sodium	EPA 200.8	10
Total Potassium	EPA 200.8	1
Sulfate	EPA 300.0	0.2
Chloride	EPA 300.0	0.2
Total Alkalinity*	EPA 310.1	1.0
Hardness*	EPA 130.0	1.0

*Parameters also measured in laboratory water.

2.8 Data Quality Objectives

Toxicity testing, analytical procedures, and results underwent quality assurance/quality control (QA/QC) review as specified in AIC's written QA/QC procedures. Toxicity test acceptance criteria are summarized in Table 2.2. Acceptance criteria for chemical analyses are provided in Table 2.3.

Table 2.2. Acceptance criteria for toxicity tests.

Test Parameter	Acceptance Criterion
Temperature	25°C ± 1°C [(a)]
DO	> 6 mg/L in all test concentrations [(c)]
pH	6.5 – 8.5 [(c)]
Performance control survival	≥ 90% [(a),(b)]
Unspiked effluent control	≥ 90% [(b)]
Percent of adversely affected organisms in laboratory water test	> 50% in at least 1 test concentration [(b)]
Percent of adversely affected organisms in effluent test	< 50% in at least 1 test concentration [(b)]
Dose response	Inverted dose response does not affect more than 2 concentrations having between 20% to 80% mortality [(b)]

Notes: (a) Based on EPA (1991)
(b) Based on EPA (2001)
(c) Based on typical levels observed during routine biomonitoring.

Table 2.3. Acceptance criteria for chemical analyses.

Analytical Parameter	Quality Control Parameter		
	Duplicate RPD	LCS % Recovery	Laboratory Blank (mg/L)
Total Recoverable Cu	± 20%	85 – 115%	< 0.001
Dissolved Cu	± 20%	NA	< 0.001
Total Recoverable Zn	± 20%	85 – 115%	< 0.001
Dissolved Zn	± 20%	NA	< 0.001
BOD-5	± 20%	NA	< 0.05
TSS	± 20%	NA	< 4
TOC	± 20%	NA	< 1.0
DOC	± 20%	NA	< 1.0
Total Calcium	± 20%	85 – 115%	< 0.1
Total Magnesium	± 20%	85 – 115%	< 0.03
Total Sodium	± 20%	85 – 115%	< 1.0
Total Potassium	± 20%	85 – 115%	< 1.0
Sulfate	± 20%	90 – 110%	< 0.2
Chloride	± 20%	90 – 110%	< 0.2
Total Alkalinity	± 20%	N/A	< 1.0
Hardness	± 20%	85 – 115%	< 1.0

2.9 Calculating and Interpreting Results

LC50 values were calculated using probit analysis or computational interpolation (e.g., Spearman-Karber or Trimmed Spearman-Karber) as allowed by the data. LC50 and WER computations were carried out to at least four decimal places to avoid rounding errors. The measurement of both total and dissolved metal in the tests allowed calculation of both a total and dissolved WER. The site-specific WERs were calculated as dissolved WERs to be consistent with ADEQ's approach to establishing permit limits. LC50 calculations based on measured metal concentrations were based on the average of the initial and final dissolved concentrations.

2.9.1 Calculating and Interpreting Results: Copper

WER calculations for Cu per EPA (2001) were as follows:

Step 1: Normalize the LC50s from the laboratory water, the site water and the SMAV to the same hardness using the formula:

$$EC50_{\,at\ Std\ Hdns} = EC50_{at\ Sample\ Hdns}\left(\frac{Std\ Hdns}{Sample\ Hdns}\right)^{\mathbf{0.9422}}$$

Where "*StdHdns*" is any particular standard hardness value to which all values will be normalized and "*Sample Hdns*" is the hardness of the laboratory water, the site water or the SMAV.

Step 2: Calculate the WER from LC50 values normalized to the same hardness by dividing the hardness-normalized effluent LC50 by the greater of either the hardness-normalized laboratory water LC50 or the hardness-normalized SMAV.

Step 3: The final site WER is then calculated as the geometric mean of the mean of the two sample WERs from separate samples collected at least one month apart.

2.9.2 Calculating and Interpreting Results: Zn

Calculation of the WER for Zn involved calculation of the hWER value per pg 30 - 60 in EPA (1994).

2.10 Biotic Ligand Model Evaluation

Effluent LC50 values for Cu were also estimated using the BLM to evaluate if the measured toxicity results were consistent with the water chemistry of the sample (i.e., calcium, magnesium, sodium, chloride, sulfate, potassium, total alkalinity, dissolved organic carbon, and pH). The pH values used as input into the model were the final measured in situ pH from the unspiked effluent exposure of the corresponding effluent toxicity tests. WER estimates were made using the BLM-predicted effluent LC50s (with appropriate hardness normalization) and the SMAV values provided in EPA (2001).The BLM analysis provides an independent means to evaluate if observed toxicity in the WER tests is consistent with expectations based on water chemistry and metal toxicology.

3.0 COPPER WER TEST RESULTS

Laboratory test reports are provided in Appendix F. All tables for Section 3.0 are located at the end of this section. Results of water chemistry analyses for all tests are presented in Table 3.1. AIC maintains tests in temperature-controlled incubators and monitors water temperature at several locations in each incubator. Records of this temperature monitoring are available on request. All tests were maintained at 25$\pm$ 1°C for the duration of the test. All LC50 values used herein were normalized to hardness = 50 mg/L (as $CaCO_3$).

3.1 Range-Finding Test

Toxicity test and Cu analysis results are provided for effluent and lab water tests in Tables 3.2 and 3.3, respectively.

3.2 Definitive Tests

Two definitive tests were conducted on 24-hour composite samples collected August 5-6, 2013, and September 29-30, 2013. Results of these tests are summarized in Tables 3.4 though 3.7.

3.3 Biotic Ligand Model Analysis

Results of the BLM-based LC50 estimates for the range-finding and definitive tests effluent mixture samples are summarized in Table 3.8.

Table 3.1. Results of water chemistry analyses of effluent and laboratory water from range-finding and definitive tests for **copper** for each sample collection date.

Parameter	Range-Finding (6/3-4/2013)		First Definitive (8/5-6/2013)		Second Definitive (9/29-360/2013)	
	Lab	Effluent	Lab	Effluent	Lab	Effluent
Total alkalinity	57	38	58	64	64	23
pH	NM	NM		7.5	8.1	7.4
TSS	NM	NM	<4	<4	< 4	<4
TOC	<1	4.3	<1	6.9	< 1	6.7
DOC	<1	3.3	NM	5.2	< 1	5.7
BOD5	NM	NM	<2	<2	<2	<2
Hardness	81.9	69.3	NM	64	81	70
Ca	13	22	NM	NM	NM	NM
Mg	12	3.6	NM	NM	NM	NM
K	2.2	4.5	NM	9.81	1.8	11
Na	26	19	NM	35.9	25	37
Cl	2.0	19	NM	36	1.9	36
SO_4	85	17	NM	22	85	20
Ammonia	NM	NM	NM	0.17	<0.1	0.21
Total Cu (µg/L)	<1	3.98	<1	4.09	< 1	11.2
Dissolved Cu (µg/L)	<1	3.88	<1	3.50	<1	9.47
Total Zn (µg/L)	2.06	20.1	8.24	89.9	<2	64.9
Dissolved Zn (µg/L)	2.63	20.1	4.74	89.2	<2	61.1

NM = not measured; All units mg/L unless indicated otherwise. Dates in parentheses indicate sample collection dates.

Table 3.2. Summary of **copper** range-finding test (effluent).

Sample Collection Date (Time)			
Sample Type	**Begin**		**End**
Effluent	6/3/2013 (09:30)		6/4/2013 (09:30)
Toxicity Test Results			
Start Date (Time) 6/7/2013 (1600)		**End Date (Time) 6/9/2013 (1520)**	
Test Exposures			**% Survival at 48 hrs. (N = 20)**
	Measured Cu (µg/L)		
Nominal	**Total**	**Dissolved**	
Unspiked Effluent	3.98*	3.88*	100
6.25	7.75**	6.50**	100
12.5	15.5*	13.0*	100
25	25.4**	19.9**	100
50	50.9**	39.7**	100
100	102*	79.4*	40
200	203**	159**	0
LC50	106.8700	83.3700	
Lower 95% CI	90.4881	70.5844	
Upper 95% CI	123.2519	96.1556	
LC50 Calculation Method	Spearman-Karber	Spearman-Karber	
Sample Hardness	70	70	
Hardness Adjusted LC50 (Hardness = 50 mg/L)	77.8348	60.7194	
SMAV(50)	12.49	11.51	
WER	6.2318	5.2754	

SMAV(50) = species mean acute value at hardness =50 mg/L per EPA (2001).*Measured values; ** Estimated based on measured values and dilution factor.

Table 3.3. Summary of **copper** range-finding test (lab water).

Start Date (Time) 6/7/2013 (1610)		End Date (Time)6/9/2013 (1525)	
Test Exposures			% Survival at 48 hrs. (N = 20)
Nominal	Measured Cu (µg/L)		
	Total	Dissolved	
Performance Control	1	1	100
3.12	3.64**	3.42**	100
6.25	7.28*	6.35*	100
12.5	13.0**	12.6**	0
25	26.1**	25.3**	0
50	52.2*	50.0*	0
LC50	10.1500	9.5000	
Lower 95% CI	Not Calculable	Not Calculable	
Upper 95% CI	Not Calculable	Not Calculable	
LC50 Calculation Method	Spearman-Karber	Trimmed Spearman-Karber	
Sample Hardness	82	82	
Hardness Adjusted LC50 (Hardness = 50 mg/L)	6.3685	5.9607	

SMAV(50) = species mean acute value at hardness = 50 mg/L per EPA (2001).*Measured values; ** Estimated based on measured values and dilution factor.

Table 3.4. Summary of first definitive **copper** WER test (effluent sample).

Sample Collection Date (Time)					
Sample Type		**Begin**		**End**	
Effluent		**8/5/2013 (11:00)**		**8/6/2013 (11:00)**	
Toxicity Test Results					
Start Date (Time) 8/8/2012 (1520)			**End Date (Time) 8/10/2013 (1715)**		
Test Exposures					**% Survival (n=20) at 48 Hrs.**
	Measured Cu (µg/L)				
	Total		**Dissolved**		
Nominal	**Initial**	**Final**	**Initial**	**Final**	
Unspiked Effluent	4.09 (4.24)	4.39	3.50 (3.61)	3.71	100
19.4	23.6 (22.4)	21.2	18.2 (16.9)	15.6	100
32.4	34.3 (34.7)	35.1	27.9 (27.8)	27.6	100
54	52.1 (50.9)	49.6	43.7 (40.9)	38.1	100
90	86.4 (81.1)	75.8	67.4 (67.1)	66.8	75
150	136 (131.5)	127	113 (111.5)	110	0
250	229 (225.0)	221	197 (187.0)	177	0
LC50*	91.7165		76.3053		
Lower 95% CI*	83.8174		69.3788		
Upper 95% CI*	100.3599		83.9233		
LC50 Calculation Method	Spearman-Karber		Spearman-Karber		
Sample hardness	64		64		
Hardness Adjusted LC50 (Hardness = 50 mg/L)	72.6832		60.4702		
SMAV(50)	12.49		11.51		
WER	5.8193		5.2537		

* Based on average of initial and final measured concentrations (values in parentheses)
SMAV(50) = species mean acute value at hardness = 50 mg/L per EPA (2001).

Table 3.5. Summary of first definitive **copper** WER test (lab water.)

Start Date (Time)			End Date (Time)		
Test Exposures					% Survival (N = 20)
	Measured Cu (µg/L)				
	Total		Dissolved		
Nominal	Initial	Final	Initial	Final	
Performance Control	<1	1.22	<1	1.12	100
3.89	4.87 (4.43)	3.99	4.23 (3.62	3.00	100
6.48	6.99 (6.74)	6.49	6.03 (5.17	4.31	100
10.8	13.0 (11.5)	9.94	10.7 (8.99)	7.27	100
18	16.8 (16.4)	15.9	16.2 (14.5)	12.7	0
30	27.3 (27.5)	27.7	23.8 (23.1)	22.3	0
50	47.2 (45.4)	43.6	43.9 (40.8)	37.7	0
LC50*	13.7332		11.4237		
Lower 95% CI*	Not calculable		Not calculable		
Upper 95% CI*	Not calculable		Not calculable		
LC50 Calculation Method	Spearman-Karber		Spearman-Karber		
Sample Hardness	89		89		
Hardness adjusted LC50 (hardness = 50)	7.9798		6.6353		

* Based on average of initial and final measured concentrations (values in parentheses)

Table 3.6. Summary of second definitive **copper** WER test (effluent sample).

Sample Collection Date (Time)					
Sample Type		**Begin**		**End**	
Effluent		9/29/2013 (08:00)		9/30/2013 (08:15)	
Toxicity Test Results					
Start Date (Time) 10/2/2013 (1715)			**End Date (Time) 10/4/2013 (1520)**		
Test Exposures					**% Survival (n=20) at 48 hrs.**
Nominal	**Measured Cu (µg/L)**				
	Total		**Dissolved**		
	Initial	**Final**	**Initial**	**Final**	
Unspiked Mixture	11.2 (7.80)	4.39	9.47 (6.59)	3.71	100%
19.4	28.5 (27.0)	25.4	25.4 (24.8)	24.2	100%
32.4	43.9 (40.7)	37.4	39.8 (36.3)	32.7	100%
54	62.2 (58.3)	54.3	47.0 (47.5)	48.0	100%
90	91.8 (88.7)	85.6	82.3 (79.8)	77.3	100%
150	146 (141.0)	136	126 (126.0)	126	95%
250	233 (227.5)	222	217 (203.0)	189	0%
LC50*	175.3675		156.2413		
Lower 95% CI*	167.6537		149.4274		
Upper 95% CI*	183.4362		163.366		
LC50 Calculation Method	Spearman-Karber		Spearman-Karber		
Sample Hardness	70		70		
Harness Adjusted LC50 (Hardness = 50mg/L)	127.7225		113.7926		
SMAV(50)	12.49		11.51		
WER	10.2260		9.8864		

* Based on average of initial and final measured concentrations (values in parentheses)
SMAV (50) = Species mean acute values at hardness = 50 mg/L per EPA (2001)

Table 3.7. Summary of second definitive **copper** WER test using lab water.

Start Date (Time)10/2/2013(1700)			**End Date (Time)10/4/2013 (1505)**		
Test Exposures					**% Survival (n=20) at 48 hrs.**
Nominal	**Measured Cu (µg/L)**				
	Total		**Dissolved**		
	Initial	**Final**	**Initial**	**Final**	
Performance Control	<1	NM	<1	NM	100
3.89	3.00 (2.71)	2.61	2.80 (2.42)	2.03	100
6.48	5.70 (5.41)	5.12	4.80 (4.38)	3.96	75
10.8	10.2 (9.33)	8.46	9.17 (8.04)	6.91	10
18.0	18.2 (17.0)	15.7	17.0 (14.9)	12.7	0
30.0	29.6 (27.8)	25.9	29.6 (26.6)	23.5	0
50.0	48.4 (47.2)	45.9	48.4 (46.2)	44.0	0
LC50*	6.5181		5.426		
Lower 95% CI*	5.735		4.7321		
Upper 95% CI*	7.4083		6.2216		
LC50 Calculation Method	Probit		Probit		
Sample Hardness	81		81		
Hardness adjusted LC50 (Hardness = 50 mg/L)	4.1373		3.4441		

* Based on average of initial and final measured concentrations (values in parentheses); NM = Not measured

Table 3.8. Summary of BLM–predicted LC50 and WER estimates for copper.

Sample	Sample Hardness	BLM-Predicted LC50		Adjusted LC50 (Hardness = 50 mg/L)	Predicted WER (Total Cu)
		mol/L	(µg/L)		
Range-Finding	70	7.22E-07	46	33.5	2.9
First Definitive	64	1.23E-06	78	61.8	5.4
Second Definitive	70	1.37E-06	87	63.8	5.5
C. dubia SMAV EC50 (µg/L) at Hardness = 100 mg/L; Appendix B in EPA (2001)					
Total Cu			Dissolved Cu		
12.49			11.51		

4.0 ZINC AND WER TEST RESULTS

Laboratory test reports are provided in Appendix G. All tables for Section 4.0 are located at the end of this section. Results of water chemistry analyses for all tests are presented in Table 4.1.

4.1 Range-Finding Tests

Results of the *C. dubia* and *P. promelas* range finding tests for Zn are provided in Tables 4.2 through 4.5.The range finding test indicated that *C. dubia* was the more sensitive species in the VCMU effluent matrix. Accordingly, one definitive test was conducted using *P. promelas* while three definitive tests used *C. dubia* per Method 1 in EPA (1994).

4.2 Definitive Tests (Type 1 and Type 2 WERs)

Three definitive tests were conducted on 24-hour composite samples collected September 29-30, 2013 (Type 1 WER), January 29-30, 2014 (Type 1 WER) and July 20-28, 2014 (Type 2 WER). Results of these tests are summarized in Tables 4.6 through 4.13. The first definitive test (Tables 4.6 and 4.7) was a Type 1 WER using only *C. dubia.* The second definitive test (Tables 4.8 through 4.11) was a Type 1 WER and used *C. dubia* and *P. promelas.* The third definitive test (Tables 4.12 through 4.13) was a Type 2 WER using only *C. dubia.* The receiving stream sample for the Type 2 WER was collected as a grab sample from the surface of Lee Creek Reservoir near the spillway on July 28, 2014 at 0830.

Table 4.1. Results of water chemistry analyses of effluent and laboratory water from range-finding and definitive tests for **zinc** for each sample collection date.

Parameter	Range-Finding (6/3-4/2013)		First Type 1 WER (9/29-30/2013)		Second Type 1 WER (1/29-30/2014)		Type 2 WER (7/27-28/2014)			
	Lab	Effluent	Lab	Effluent	Lab	Effluent	Lab	Effluent	Receiving Stream	Mixture*
Total alkalinity	57	38	NM	23	NM	13	64	45	39	40
pH	NM	NM	NM	7.4	NM	6.7	8	7.3	7.4	7.2
TSS	NM	NM	<4	<4	NM	<4	< 4	< 4	5.6	< 4
TOC	NM	4.3	<1	6.7	NM	3.8	1.7	6.4	2.8	2.9
DOC	NM	3.3	<1	5.7	NM	3.5	< 1	5.0	1.7	1.7
BOD5	NM	NM	<2	<2	NM	<2	< 2	< 2	< 2	< 2
Hardness	69.8	81.9	81	70	88	42.7	94	53	35	36
Ca	13	22	NM	NM	NM	NM	NM	NM	NM	NM
Mg	12	3.6	NM	NM	NM	NM	NM	NM	NM	NM
K	2.2	4.5	1.8	11	NM	NM	NM	NM	NM	NM
Na	26	19	25	37	NM	NM	NM	NM	NM	NM
Cl	2.0	19	1.9	36	NM	NM	NM	NM	NM	NM
SO_4	85	17	NM	NM	NM	NM	NM	NM	NM	NM
Ammonia	NM	NM	NM	0.21	NM	<0.1	NM	< 0.1	< 1	< 1
Total Cu (ug/L)	<1	NM	<1	11.2	NM	5.61	NM	4.78	< 2	< 2
Dissolved Cu (ug/L)	<1	3.88	<1	9.47	NM	4.73	NM	3.60	< 2	< 2
Total Zn (ug/L)	2.06	20.1	<2	61.1	NM	95.1	NM	93.5	< 0.1	< 0.1
Dissolved Zn (ug/L)	2.63	20.1	<2	64.9	NM	94.6	NM	91.2	< 1	1.04

NM = not measured; All units mg/L unless indicated otherwise. Dates in parentheses indicate sample collection dates
* 98.8% receiving stream + 1.2% effluent

Table 4.2. Summary of the *C. dubia* range-finding test for **zinc** in effluent.

Sample Collection Date (Time)		
Sample Type	**Begin**	**End**
Effluent	6/3/2013 (0930)	6/4/2013 (0930)

Toxicity Test Results					
Start Date (Time) 6/7/2013 (1620)			**End Date (Time) 6/9/2013 (1530)**		
Test Exposures					**% Survival (n=20) at 48 hrs.**
	Measured Cu (µg/L)				
	Total		**Dissolved**		
Nominal	**Initial**	**Final**	**Initial**	**Final**	
Unspiked Effluent	20.1	NM	20.1	NM	100
18.75	NM	NM	NM	NM	100
37.5	60.2 (54.8)	49	58 (52.1)	46	100
75	NM	NM	NM	NM	100
150	NM	NM	NM	NM	0
300	341 (311.0)	281	325 (286.5)	248	0
600	126.	NM	114.5	NM	0
LC50*	126.1		114.5		
Lower 95% CI*	NA		NA		
Upper 95% CI*	NA		NA		
LC50 Calculation Method	Interpolation		Interpolation		
Sample Hardness	69.3		69.3		
Harness Adjusted LC50 (Hardness = 100mg/L)	172.0528		156.2256		
WER **	1.1188		1.1289		

* Based on average of initial and final measured concentrations (values in parentheses)
** Based on lab water; NA = not applicable; NM = not measured

Table 4.3. Summary of the *C. dubia* range-finding test for **zinc** in lab water

Sample Collection Date (Time)		
Sample Type	**Begin**	**End**
Lab Water	NA	NA

Toxicity Test Results					
Start Date (Time) 6/7/2013 (1630)			**End Date (Time) 6/9/2013 (1535)**		
Test Exposures					**% Survival (n=20) at 48 hrs.**
	Measured Zn (µg/L)				
	Total		**Dissolved**		
Nominal	**Initial**	**Final**	**Initial**	**Final**	
Performance Control	< 1	< 1	< 1	< 1	100
9.4	NM	NM	NM	NM	100
18.8	21 (25.9)	30	22 (23.8)	24	100
37.5	NM	NM	NM	NM	100
75	NM	NM	NM	NM	80
150	150 (147.5)	145	154 (153.5)	153	50
300	NM	NM	NM	NM	0
LC50*	128.7		117.9		
Lower 95% CI*	NA		NA		
Upper 95% CI*	NA		NA		
LC50 Calculation Method	Interpolation		Interpolation		
Sample Hardness	81.9		81.9		
Hardness Adjusted LC50 (Hardness = 100mg/L)	152.4239		139.6331		

* Based on average of initial and final measured concentrations (values in parentheses)

Table 4.4. Summary of the *P. promelas* range-finding test for **zinc** in effluent.

Sample Collection Date (Time)		
Sample Type	**Begin**	**End**
Effluent	6/3/2013 (0930)	6/4/2013 (0930)

Toxicity Test Results					
Start Date (Time) 6/7/2013 (1620)			**End Date (Time) 6/9/2013 (1530)**		
Test Exposures					**% Survival (n=20) at 48 hrs.**
Nominal	**Measured Cu (µg/L)**				
	Total		**Dissolved**		
	Initial	**Final**	**Initial**	**Final**	
Performance Control	NM	NM	NM	NM	100
46.9	49.1 (49.4)	49.6	51.7 (52.2)	52.7	100
93.8	NM	NM	NM	NM	100
188	NM	NM	NM	NM	100
375	NM	NM	NM	NM	100
750	745 (751)	704	741 (731)	720	0
1500	NM	NM	NM	NM	0
LC50*	425		400		
Lower 95% CI*	NA		NA		
Upper 95% CI*	NA		NA		
LC50 Calculation Method	Interpolation		Interpolation		
Sample Hardness	69.3		69.3		
Harness Adjusted LC50 (Hardness = 100mg/L)	600		532		
WER **	1.2436		1.1121		

* Based on average of initial and final measured concentrations (values in parentheses)
** Based on lab water; NA = not applicable; NM = not measured

Table 4.5. Summary of the *P. promelas* range-finding test for **zinc** in lab water.

<table>
<tr><th colspan="6">Sample Collection Date (Time)</th></tr>
<tr><th colspan="2">Sample Type</th><th colspan="2">Begin</th><th colspan="2">End</th></tr>
<tr><td colspan="2">Effluent</td><td colspan="2">NA</td><td colspan="2">NA</td></tr>
<tr><th colspan="6">Toxicity Test Results</th></tr>
<tr><th colspan="3">Start Date (Time) 6/7/2013 (1630)</th><th colspan="3">End Date (Time) 6/9/2013 (1535)</th></tr>
<tr><th colspan="5">Test Exposures</th><th rowspan="4">% Survival (n=20) at 48 hrs.</th></tr>
<tr><th rowspan="3">Nominal</th><th colspan="4">Measured Zn (µg/L)</th></tr>
<tr><th colspan="2">Total</th><th colspan="2">Dissolved</th></tr>
<tr><th>Initial</th><th>Final</th><th>Initial</th><th>Final</th></tr>
<tr><td>46.9</td><td>49.1
(49.4)</td><td>49.6</td><td>51.7
(52.2)</td><td>52.7</td><td>100</td></tr>
<tr><td>93.8</td><td>NM</td><td>NM</td><td>NM</td><td>NM</td><td>100</td></tr>
<tr><td>188</td><td>NM</td><td>NM</td><td>NM</td><td>NM</td><td>100</td></tr>
<tr><td>375</td><td>373
(362.3)</td><td>352</td><td>371
(365.3)</td><td>360</td><td>100</td></tr>
<tr><td>750</td><td>745
(725)</td><td>704</td><td>741
(731)</td><td>720</td><td>0</td></tr>
<tr><td>LC50*</td><td colspan="2">400</td><td colspan="2">401</td><td rowspan="6"></td></tr>
<tr><td>Lower 95% CI*</td><td colspan="2">NA</td><td colspan="2">NA</td></tr>
<tr><td>Upper 95% CI*</td><td colspan="2">NA</td><td colspan="2">NA</td></tr>
<tr><td>LC50 Calculation Method</td><td colspan="2">Interpolation</td><td colspan="2">Interpolation</td></tr>
<tr><td>Sample Hardness</td><td colspan="2">81.9</td><td colspan="2">81.9</td></tr>
<tr><td>Hardness Adjusted LC50
(Hardness = 100mg/L)</td><td colspan="2">482.7963</td><td colspan="2">474.9688</td></tr>
</table>

* Based on average of initial and final measured concentrations (values in parentheses)

Table 4.6. Summary of the first definitive (Type 1 WER) **zinc** WER test (effluent sample) using *C. dubia.*

Sample Collection Date (Time)					
Sample Type		**Begin**		**End**	
Effluent		9/29/2013 (0800)		9/30/2013 (0815)	
Toxicity Test Results					
Start Date (Time) 10/2/2013 (1730)			**End Date (Time) 10/4/2013 (1535)**		
Test Exposures					**% Survival (n=20) at 48 hrs.**
Nominal	**Measured Cu (µg/L)**				
	Total		**Dissolved**		
	Initial	**Final**	**Initial**	**Final**	
Unspiked Effluent	61.1	NM	64.9	NM	100
19.4	76.6 (77.5)	78.3	75.5 (726.)	69.7	100
32.4	90.6 (86.0)	81.4	88.8 (84.9)	81.0	100
54	101 (98.5)	96.0	98.7 (97.8)	96.9	100
90	132 (135)	137	125 (123)	122	100
150	169 (171)	172	160 (157)	154	90
250	236 (249)	263	236 (225)	213	0
LC50 *	200.0437		182.2135		
Lower 95% CI*	192.1650		175.1935		
Upper 95% CI*	208.2454		189.5148		
LC50 Calculation Method	Spearman-Karber		Spearman-Karber		
Sample Hardness	70		70		
Harness Adjusted LC50 (Hardness = 50mg/L)	150.4217		137.0144		
WER**	1.6089		1.5310		

* Based on average of initial and final measured concentrations (values in parentheses)
** Based on lab water

Table 4.7. Summary of the first definitive (Type 1 WER) **zinc** WER test (laboratory water) using *C. dubia.*

Start Date (Time) 10/2/2013(1700)			End Date (Time)10/4/2013 (1505)		
Test Exposures					% Survival (n=20) at 48 hrs.
Nominal	Measured Cu (µg/L)				
	Total		Dissolved		
	Initial	Final	Initial	Final	
Performance Control	NM	NM	NM	NM	95
3.89	19.3 (13.5)	22.9	18.7 (19.5)	20.2	100
6.48	34.3 (34.2)	34.0	34.0 (33.5)	33.0	100
10.8	50.4 (51.2)	52.0	47.2 (46.9)	46.5	100
18	90.8 (90.0)	89.1	86.5 (85.5)	84.4	95
30	138 (135)	132	138 (131)	125	55
50	237 (231)	225	222 (216)	211	0
LC50*	140.7003		134.6819		
Lower 95% CI*	116.6619		113.4314		
Upper 95% CI*	169.6917		159.9134		
LC50 Calculation Method	Spearman-Karber		Spearman-Karber		
Sample Hardness	81		81		
Hardness adjusted LC50 (Hardness = 50 mg/L)	93.4917		89.4926		

* Based on average of initial and final measured concentrations (values in parentheses); NM = Not measured

Table 4.8. Summary of the second definitive (Type 1 WER) **zinc** WER test (effluent sample) using *C. dubia.*

Sample Collection Date (Time)					
Sample Type	**Begin**		**End**		
Effluent	1/29/2014 (1000)		1/30/2014 (1000)		
Toxicity Test Results					
Start Date (Time) 1/31/2014 (1725)			**End Date (Time) 2/2/2014 (1530)**		
Test Exposures					**% Survival (n=20) at 48 hrs.**
Nominal	**Measured Cu (µg/L)**				
	Total		**Dissolved**		
	Initial	**Final**	**Initial**	**Final**	
Unspiked Effluent	95.1	ND	94.6	ND	100
29	125 (130)	135	124 (130)	136	100
44.6	136 (140)	144	135 (140)	145	100
68.7	159 (163)	166	158 (160)	162	90
106	196 (197)	198	194 (195)	195	55
162	246 (255)	263	244 (249)	255	0
250	337 (344)	351	327 (335)	344	0
LC50 *	196.7666		196.0838		
Lower 95% CI*	186.4157		185.9548		
Upper 95% CI*	207.6923		206.7644		
LC50 Calculation Method	Spearman-Karber		Spearman-Karber		
Sample Hardness	42.7		42.7		
Harness Adjusted LC50 (Hardness = 50mg/L)	224.9195		224.1390		
WER**	3.9188		3.9138		

* Based on average of initial and final measured concentrations (values in parentheses)
** Based on lab water

Table 4.9. Summary of the second definitive (Type 1 WER) zinc WER test (laboratory water) using *C. dubia.*

Start Date (Time) 1/31/2014(1700)			End Date (Time) 2/2/2014 (1540)		
Test Exposures					% Survival (n=20) at 48 hrs.
Nominal	Measured Cu (µg/L)				
	Total		Dissolved		
	Initial	Final	Initial	Final	
Performance Control	NM	NM	NM	NM	100
29	28.3	36.1	29.4	36.3	100
44.6	43.7	47.9	43.7	47.2	100
68.7	67.0	70.9	67.9	71.6	75
106	104	109	102	109	40
162	161	170	160	169	0
250	241	259	236	258	0
LC50*	92.6608		92.458		
Lower 95% CI*	76.3116		79.0203		
Upper 95% CI*	112.5126		108.1808		
LC50 Calculation Method	Spearman-Karber		Spearman-Karber		
Sample Hardness	88		88		
Hardness adjusted LC50 (Hardness = 50 mg/L)	57.3949		57.2693		

* Based on average of initial and final measured concentrations (values in parentheses); NM = Not measured

Table 4.10. Summary of the second definitive (Type 1 WER) **zinc** WER test (effluent sample) using *P. promelas.*

Sample Collection Date (Time)					
Sample Type	**Begin**		**End**		
Effluent	1/29/2014 (1000)		1/30/2014 (1000)		
Toxicity Test Results					
Start Date (Time) 1/31/2014 (1630)			**End Date (Time) 2/2/2014 (1440)**		
Test Exposures					**% Survival (n=20) at 48 hrs.**
Nominal	**Measured Cu (µg/L)**				
	Total		**Dissolved**		
	Initial	**Final**	**Initial**	**Final**	
Unspiked Effluent	95.1	NM	94.6	NM	100
174	272 (287)	302	270 (280)	290	100
268	371 (386)	401	366 (384)	403	100
412	520 (544)	568	516 (533)	550	65
634	755 (776)	797	741 (786)	830	55
975	1110 (1130)	1140	1110 (1170)	1220	15
1500	1690 (1730)	1780	1650 (1710)	1770	0
LC50 *	745.8343		750.5357		
Lower 95% CI*	658.3549		689.9425		
Upper 95% CI*	844.9376		853.5651		
LC50 Calculation Method	Spearman-Karber		Spearman-Karber		
Sample Hardness	42.7		42.7		
Harness Adjusted LC50 (Hardness = 50mg/L)	865.4167		870.8668		
WER**	3.4041		3.5104		

* Based on average of initial and final measured concentrations (values in parentheses)
** Based on lab water

Table 4.11. Summary of the second definitive (Type 1 WER) zinc WER test (laboratory water) using *P. promelas.*

Start Date (Time) 1/31/2014(1700)			End Date (Time) 2/2/2014 (1540)		
Test Exposures					% Survival (n=20) at 48 hrs.
Nominal	Measured Cu (µg/L)				
	Total		Dissolved		
	Initial	Final	Initial	Final	
Performance Control	NM	NM	NM	NM	100
174	173 (178)	183	172 (177)	183	100
268	266 (276)	286	263 (273)	283	95
412	416 (425)	434	410 (421)	431	35
634	648 (666)	683	629 (651)	673	15
975	989 (978)	968	984 (907)	829	10
1500	1490 (1480)	1460	1380 (1250)	1130	0
LC50*	433.0487		422.5923		
Lower 95% CI*	379.8431		373.2415		
Upper 95% CI*	493.7068		478.4685		
LC50 Calculation Method	Spearman-Karber		Spearman-Karber		
Sample Hardness	88		88		
Hardness adjusted LC50 (Hardness = 50 mg/L)	254.2229		248.0844		

* Based on average of initial and final measured concentrations (values in parentheses); NM = Not measured

Table 4.12. Summary of the third definitive (Type 2 WER) **zinc** WER test (effluent sample) using *C. dubia.*

Sample Collection Date (Time)					
Sample Type	**Begin**		**End**		
Effluent	7/27/2014 (0800)		7/28/2014 (0800)		
Toxicity Test Results					
Start Date (Time) 7/28/2014 (1650)			**End Date (Time) 7/31/2014 (1450)**		
Test Exposures					**% Survival (n=20) at 48 hrs.**
	Measured Cu (µg/L)				
	Total		**Dissolved**		
Nominal	**Initial**	**Final**	**Initial**	**Final**	
Unspiked Mixture	< 2	NM	< 2	NM	100
5.66	7.05 (6.11)	5.17	3.30 (3.69)	4.07	100
8.70	10.9 (9.06)	7.22	4.84 (5.15)	5.45	100
13.4	14.3 (11.9)	9.57	6.23 (6.95)	7.66	100
20.6	20.5 (17.2)	13.8	10.1 (10.9)	11.7	100
31.7	27.8 (25.8)	23.7	18.3 (19.8)	21.3	15
48.8	44.7 (41.9)	39.0	33.8 (32.7)	31.5	0
75.0	75.8 (68.4)	61.0	59.7 (55.7)	51.6	0
LC50 *	20.6814		14.3047		
Lower 95% CI*	18.8243		12.532		
Upper 95% CI*	22.7216		16.3282		
LC50 Calculation Method	Probit		Probit		
Sample Hardness	36		36		
Harness Adjusted LC50 (Hardness = 50mg/L)	27.3188		18.8956		
WER**	0.4225		0.2914		

* Based on average of initial and final measured concentrations (values in parentheses)
** Based on lab water; NM - not measured

Table 4.13. Summary of the third definitive (Type 2 WER) **zinc** WER test (laboratory water) using *C. dubia.*

Start Date (Time) 7/292014(1630)			**End Date (Time) 7/31/2014 (1430)**		
Test Exposures					**% Survival (n=20) at 48 hrs.**
Nominal	**Measured Cu (µg/L)**				
	Total		**Dissolved**		
	Initial	**Final**	**Initial**	**Final**	
Performance Control	NM	NM	NM	NM	100
46.4	42.7 (47.2)	51.7	42.6 (46.9)	51.2	100
71.4	69.0 (75.2)	81.3	71.7 (76.7)	81.7	85
110	110 (117)	124	111 (117)	122	65
169	171 (180)	189	175 (181)	187	0
260	266 (278)	290	266 (277)	289	0
400	418 (441)	464	418 (440)	462	0
LC50*	110.3831		110.7001		
Lower 95% CI*	98.2087		98.8059		
Upper 95% CI*	124.0666		124.0262		
LC50 Calculation Method	Probit		Spearman-Karber		
Sample Hardness	94		94		
Hardness adjusted LC50 (Hardness = 50 mg/L)	64.6560		64.8417		

* Based on average of initial and final measured concentrations (values in parentheses); NM = Not measured

5.0 DISCUSSION AND DATA ANALYSIS

5.1 Test Acceptability and Quality Assurance

All tests were begun within required holding times. All chemical analyses met acceptance criteria given in Table 2.3. All toxicity tests met performance criteria given in Table 2.2. All in situ test measurements were within acceptance criteria (Table 2.2).With the exception of the total and dissolved measurement in the unspiked effluent exposure of the second definitive Cu test (Table 3.12) no measured metal concentrations changed by more than 50% between the initial and final measurements. This result verifies that static non-renewal tests were appropriate for the purposes of this study (per Appendix A Section E.7 in EPA 2001).

5.2 WER Calculations Based on Biotic Ligand Analysis

Table 5.1 summarizes a comparison of BLM-based and measured LC50 values (standardized to hardness = 50 mg/L) and WER values based on measured dissolved Cu concentrations. Agreement between measured and BLM-predicted LC50 values were within the level of agreement reported in the literature(Figure 11 in Di Toro et al 2001).This comparison indicates that the measured WER values agree with expectations based on Cu toxicology and water chemistry.

Table 5.1. Comparison of BLM-estimated versus measured effluent LC50 (at hardness = 50mg/L) and WER estimates.

Sample	LC50		WER	
	BLM	**Measured**	**BLM**	**Measured**
Range-Finding	33.5	60.7	2.9	5.3
First Definitive	61.8	60.4	5.4	5.3
Second Definitive	63.3	114	5.5	9.9

Notes: Measured LC50 values are normalized to a hardness of 50 mg/L and are based on measured dissolved Cu concentrations. All WER values are based on the SMAV from EPA (2001).

5.3 Final WER Calculations

5.3.1 Copper

Cu WER test results are summarized in Table 5.2.The final WER calculated as the geometric mean of the WERs from the two definitive tests is $(9.8864 \times 5.2537)^{0.5} = 7.2069$.The WER that would be required to result in compliance with the existing Cu limits (7-day average = 18.5 µg/L; Monthly Average = 8.9 µg/L) can be estimated by computing the "exceedance factor"[4]from existing DMR data. Selected percentile values for exceedance factors computed for DMR data from January 2011 - December 2013 are provided in Table 1.2. The table indicates that the 95th percentile exceedance factor for the monthly average is 2.05. Accordingly the proposed WER for Cu is 2.0. This value is well below the measured WER of 7.2, providing a margin of safety.

Table 5.2. Summary of **copper** WER test results.

Test Series	Sample Type	LC50 (Dissolved Cu, µg/L)		Hardness (mg/L as $CaCO_3$)	Dissolved WER**
		Unadjusted	**Hardness* Adjusted**		
Range finding	Effluent	83.3700	60.7195	70	5.2754
	Lab	9.5000	5.9607	82	NA
First Definitive	Effluent	76.0543	72.6832	64	5.2537
	Lab	11.4237	6.63531	89	NA
Second Definitive	Effluent	156.2413	113.7926	70	9.8864
	Lab	5.4260	3.4441	81	NA

NA = not applicable
* Hardness= 50 mg/L; ** All WERs based on SMAV from EPA (2001)

5.3.2 Zinc

Zn WER test results are summarized in Table 5.3. In contrast to the calculations for deriving the WER for Cu based on EPA (2001) the calculations to derive the Zn WER are based on pages 30-31 and 36 in EPA (1994) and are considerably more complicated. The relevant text from these sections of the EPA (1994) guidance is reproduced below.

[4]Exceedance factor = reported value ÷ permit limit.

Table 5.3. Summary of zinc WER test results.

Series	Species	Sample type	LC50 (Dissolved Cu, µg/L)		Hardness (mg/L as $CaCO_3$)	WER**
			Unadjusted	Hardness Adjusted *		
Range Finding	*C. dubia*	Effluent	114.5000	156.2256	69	1.1188
		Lab	117.9000	139.6331	82	NA
	P. promelas	Effluent	390.0941	532.2506	69	1.1206
		Lab	401.0426	474.9688	82	NA
1st Definitive	*C. dubia*	Effluent	182.2135	137.0144	70	1.5310
		Lab	134.6819	89.4926	81	NA
2nd Definitive	*C. dubia*	Effluent	196.0838	224.1390	43	3.9138
		Lab	92.4580	57.2693	88	NA
	P. promelas	Effluent	750.5357	870.8668	43	3.5104
		Lab	422.5923	248.0845	88	NA
3rd Definitive	*C. dubia*	Effluent	14.3047	18.8956	36	0.2914
		Lab	110.7001	64.8417	94	NA

NA - not applicable; * Hardness = 50 mg/L; ** All WERs based on laboratory water LC50s

5.3.2.1 hWER Calculation

The values obtained for calculating the hWER for each Zn WER test (two type 1 WERs and one type 2 WER) based on the guidance are provided in Table 5.4.

Pages 30-31 in EPA (1994):

> *For the first way of using high-flow WERs, they are used directly as environmentally conservative estimates of the design-flow WER. For the second way of using high-flow WERs, each is used to calculate the highest concentration of metal that could be in the effluent without causing the concentration of metal in the downstream water to exceed the site-specific criterion that would be derived for that water using the experimentally determined WER. This highest concentration of metal in the effluent (HCME) can be calculated as:*
>
> $$HCME=\frac{[(CCC)(WER)(eFLOW + uFLOW)]-[(uCONC)(uFLOW)]}{eFLOW}$$
>
> *Where:*
>
> *CCC = the national, state, or recalculated CCC (or CMC) that is to be adjusted*

eFLOW = the flow of the effluent that was the basis of the preparation of the simulated downstream water. This should be the flow of the effluent that existed when the samples were taken.

uFLOW = the flow of the upstream water that was the basis of the preparation of the simulated downstream water. This should be the flow of the upstream water that existed when the samples were taken.

uCONC = the concentration of metal in the sample of upstream water used in the preparation of simulated downstream water.

In order to calculate a HCME from an experimentally determined WER, the only information needed besides the flows of the effluent and the upstream water is the concentration of metal in the upstream water, which should be measure anyway in conjunction with the determination of the WER.

When a steady-state model is used to derive permit limits, the limits on the effluent apply at all flows; this, each HCME can be used to calculated the highest WER (hWER) that could be used to derive site-specific criterion for the downstream water at design flow so that there would be adequate protection at the flow for which the HCME was determined. The hWER is calculated as:

$$hWER = \frac{(HCME)\ (eFLOW) + (uCONCdf)(uFLOWdf)}{(CCC)(eFLOWdf + uFLOWdf)}$$

The suffix "df" indicates that the values used for these quantities in the calculation of the hWER are those that exist at design-flow conditions. The additional datum needed in order to calculate the hWER is the concentration of metal in upstream water at design-flow conditions; if this is assumed to be zero, the hWER will be environmentally conservative. If a WER is determined when uFLOW equals the design flow, hWER=WER.

Table 5.4. Summary of HCME and hWER calculations.

		Test		
		First Definitive (Type 1 WER)	**Second Definitive (Type 1 WER)**	**Third Definitive (Type 2 WER)**
Input for HCME and hWER Calculation	CCC	126.3	126.3	126.3
	WER	1.531	3.9138	0.2914
	eFlow	0.693	0.865	0.737
	uFlow	0	0	61.4
	uConc	1	1	1
	eFlowdf	2	2	2
	uFlowdf	0	0	0
	uConcdf	1	1	1
HCME		193.3653	494.3129	3019.646
hWER		1.531	3.9138	23.90852

5.3.2.1 FWER Calculation

Determining the final WER (FWER) is based on the guidance provided on pg 36 of EPA (1994) which is provided in its entirety below. The results obtained from the ZN WER testing provided herein match condition 1.a.1 shown below. Accordingly the FWER for Zn using this guidance is the lowest of the Type 1 WERs which is 1.5.

Page 36 of EPA (1994):

Three Type 1 and/or Type 2 WERs, which were determined using acceptable procedures and for which there were at least three weeks between any two sampling events, must be available in order for a FWER to be derived. If three or more are available, the FWER should be derived from the WERs and hWERs using the lowest numbered option whose requirements are satisfied:

1. If there are two or more Type 1 WERs:
a. If at lease nineteen percent of all of the WERs are Type 2 WERs, the derivation of the FWER depends on the properties of the Type 1 WERs:
1. If the range of the Type 1 WERs is not greater than a factor of 5 and/or the range of the ratios of the Type 1 WER to the concentration of metal in the simulated downstream water is not greater than a factor of 5, the FWER is the lower of (a) the adjusted geometric mean (see Figure 2) of all of the Type 1 WERs and (b) the lowest hWER.

2. If the range of the Type 1 WERs is greater than a factor of 5, the FWER is the lowest of (a) the lowest Type 1 WER, (b) the lowest hWER, and (c) the geometric mean of all the Type 1 and Type 2 WERs, unless an analysis of the joint probabilities of the occurrences of WERs and metal concentrations indicates that a higher WER would still provide the level of protection intended by the criterion. (EPA intends to provide guidance concerning such an analysis.)

b. If less than nineteen percent of all the WERs are Type 2 WErs, the FWER is the lower of (1) the lowest Type 1 WER and (2) the lowest hWER.

2. If there is one Type 1 WER, the FWER is the lowest of (a) the Type 1 WER, (b) the lowest hWER, and (c) the geometric mean of all of the Type 1 and Type 2 WERs.

3. If there are no Type 1 WERs, the FWER is the lower of (a) the lowest Type 2 WER and (b) the lowest hWER. If fewer than three WERs are available and a site-specific criterion is to be derived using a WER or a FWER, the WER or FWER has to be assumed to be 1.

5.4 Combined Metal Test

The purpose of the combined metal test is to evaluate the combined toxicity of both metals at the proposed criteria levels. The proposed criteria were based on the final WER (FWER) calculations presented in Section 5.3.These calculations arrived at FWER values of 2.0 and 1.5 for Cu and Zn, respectively. Original criteria (based on the default WER = 1, hardness = 25 mg/L and a total to dissolved correction factor based on a TSS value of 3) and the proposed criteria based on the WER values obtained from the testing described herein are summarized in Table 5.5. The results of the combined metal toxicity test in which Cu and Zn were spiked into effluent at target concentrations of 21.98 and 145.215 µg/L Cu and Zn, respectively, are presented in Table 5.6

The results provided in Table 5.6 indicate that the percent survival at the concentration representing the combined criteria as not statistically different from the control. However, the difference was very close to statistical significance. This result indicates that the proposed criteria would only be marginally protective, with little or no margin of safety. Accordingly, the FWER values obtained based on the test results presented herein cannot be expected to support a site-specific modification of the existing criteria for Cu and Zn.

Table 5.5. Summary of original and proposed criteria.

Parameter	Original Criteria Acute (µg/L)	Original Criteria Chronic (µg/L)	WER	Proposed Criteria (µg/L)
Copper	10.99	8.28	2	10.99 x 2 = 21.98
Zinc	96.81	88.4	1.5	96.81 x 1.5 = 145.215

Table 5.6. Summary of the "combined metal" on spiked effluent using *C. dubia*.

Sample Collection Date (Time)		
Sample Type	**Begin**	**End**
Effluent	11/11/2014 (0800)	11/12/2014 (0800)

Toxicity Test Results

Start Date (Time) 11/14/2014 (1610) — **End Date (Time) 11/16/2014 (1535)**

Test Exposures*									% Survival (n=20) at 48 hrs.
	Measured Cu (µg/L)				Measured Zn (µg/L)				
	Total		Dissolved		Total		Dissolved		
Nominal	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
Unspiked Mixture	5.11	NM	4.53	NM	53.0	NM	51.7	NM	100
Conc 1	11.3 (11.3)	11.2	10.8 (10.5)	10.2	64.6 (67.0)	69.4	63.6 (66.6)	69.6	100
Conc 2	17.3 (16.7)	16.1	15.4 (15.2)	14.9	98.2 (100)	102	96.8 (98.9)	101	90
Conc 3 Proposed Criteria Level	26.4 (25.6	24.7	24.2 (23.7)	23.2	137 (142)	147	139 (141)	142	80
Conc 4	42.1 (41.1)	40.0	37.0 (31.3)	25.6	233 (237)	241	222 (225)	228	0 **
Conc 5	59.9 (58.3)	56.7	52.7 (51.3)	49.8	367 (364)	361	350 (344)	338	0**
Sample Hardness	68								

* Average of initial and final measured concentrations (values in parentheses); NM - not measured

**Statistically less than the control (P < 0.05)

6.0 SUMMARY AND CONCLUSIONS

WER tests were conducted per agency guidance (EPA 1994 and EPA 2001).Toxicity tests met data quality objectives and provided valid data sets for deriving site-specific WERs. Based on the method guidance and test results the empirically obtained WERs were 7.9 and 1.5 for Cu and Zn, respectively. The proposed WERs were based on the WER values that would be required to result in 95% compliance with the permit limits. These WERs were 2.0 and 1.6 for Zn respectively. The experimentally obtained WER of 7.9 for Cu was adequate to accommodate a value of 2.0 but the test data would only support a Zn WER of 1.5. Accordingly, the combined metal test was performed to evaluate Cu and Zn criteria adjusted using WER values of 2.0 and 1.5 for Cu and Zn, respectively. The results of the combined test indicated that the proposed criteria would only be marginally protective, with little or no margin of safety.

7.0 LITERATURE CITED

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APPENDIX A

Evaluation of Whole Effluent Toxicity in Routine Biomonitoring Tests

EVALUATION OF WHOLE EFFLUENT TOXICITY IN ROUTINE BIOMONITORING TESTS

1.0 OVERVIEW

Under the present permit (effective March 1, 2008) for Van Buren Municipal Utilities (VBMU), there have been seven episodes of whole effluent toxicity (WET) in routine biomonitoring through February 2014 (Table A.1). Testing conducted during late 2013 and early 2014 indicated sufficient levels and frequency of lethal toxicity to require a toxicity reduction evaluation (TRE). As of this writing the TRE project has not yet identified the cause(s) o toxicity. Prior to the episodes of toxicity the facility was in the process of developing water-effects ratios (WERs) for copper (Cu) and zinc (Zn) to address the exceedances of limitations for these metals in the discharge. Episodes of WET that are due to Cu or Zn concentrations will preclude the possibility of development of WERs for Cu and Zn because the primary justification for a implementing the WERs is that Cu and/or Zn do not cause toxicity in the discharge. Accordingly, available WET and analytical data were examined be to evaluate whether or not observed levels and patterns of toxicity were consistent with levels and patterns of Cu and Zn concentrations.

The approach to this evaluation focuses on a necessary condition to demonstrate cause and effect, namely, that the cause (elevated metal concentrations) and effect (reduced survival and/or reproduction in *Ceriodaphnia dubia*) co-occur. Specifically, this requires the following:

1. Episodes of WET toxicity must occur during periods of elevated metal (Cu and/or Zn) concentrations in the discharge, and
2. A correlation (i.e., dose-response) must exist between metal concentrations and indicators of toxicity (i.e., reduced survival).

This analysis evaluates these two conditions.

Table A.1. Summary of NOEC (percent effluent) from the most recent 3 years of routine biomonitoring at the Van Buren North Treatment Plant Outfall 001.

Sampling Dates	*Pimephales promelas*		*Ceriodaphnia dubia*	
	Survival	**Growth**	**Survival**	**Reproduction**
02/16-21/2014	100	100	< 32	< 32
01/19-24/2014	No Test	No Test	100	100
12/08-12/2013	No Test	No Test	100	100
11/17-21/2013	No Test	No Test	< 32	< 32
10/13-17/2013	100	100	< 32	< 32
07/14-18/2013	100	100	100	100
05/12-16/2013	100	100	100	100
01/27-31/2013	100	100	100	100
11/11-15/2012	100	100	100	100
07/22-26/2012	100	100	100	100
04/15-19/2012	100	100	100	100
01/15-19/2012	100	100	100	100
11/13-17/2011	100	100	100	100
07/10-14/2011	100	100	100	100
04/03-07/2011	100	100	100	100
03/06-10/2011	No Test	No Test	100	100
01/23-27/2011	100	100	Control Failure	Control Failure
12/05-09/2010	No Test	No Test	100	100
11/14-18/2010	100	100	100	100
10/24-28/2010	100	100	100	< 100
07/18-22/2010	100	100	100	100
04/11-15/2010	100	100	100	100
01/10-14/2010	100	100	100	100
11/29-03/2009	100	100	< 100	< 100
11/08-12/2009	100	100	100	100
10/25-29/2009	100	100	100	100
09/13-17/2009	< 100	< 100	100	< 100
08/30-03/2009	No Test	No Test	100	100
07/26-30/2009	No Test	No Test	100	100
06/23-28/2009	No Test	No Test	100	100
06/07-11/2009	100	100	100	< 100
02/22-26/2009	100	100	100	100

2.0 COMPARING AND EVALUATING METAL CONCENTRATIONS: HARDNESS ADJUSTMENT

The empirical relationships between hardness and the toxicity of Cu and Zn are well known and are part of the derivation of water quality standards for those metals. As hardness increases, the concentration of Cu or Zn at which toxicity is observed also increases. As hardness decreases, the amount of bioavailable metal increases, increasing the likelihood of toxicity. Therefore, for the purpose of evaluating toxicity, comparisons of concentrations of metals such as Cu and Zn should include adjusting (or “normalizing”) the concentrations to the same hardness. Unless otherwise noted, the Cu and Zn concentrations discussed herein were normalized to a hardness of 50 mg/L (as $CaCO_3$) using the formula given in Section 2.6 of the attached WER report. The exponents used herein for normalizing Cu and Zn concentrations were 0.9422 and 0.8473, respectively (APCEC 2011).

3.0 TEMPORAL PATTERNS OF WET EXCURSIONS AND DISCHARGE COPPER CONCENTRATIONS

Figures A.1 and A.2 show time-series plots of Cu and Zn concentrations with an indication of when episodes of toxicity were observed (i.e., routine WET testing showing statistically significant levels of lethal or sub-lethal toxicity) for the period of the current permit. From permit issuance through the first quarter 2013, VBMU collected samples for Cu and Zn analysis as part of the second composite sample collected for routine WET testing. Beginning with the second quarter 2013, water chemistry analyses were conducted on each of the three composite samples collected for routine WET testing. Therefore, the data points for Cu and Zn concentrations and WET analyses on Figures A.1 and A.2 represent concurrent measurements. The metal concentrations used for this analysis were not normalized to a common hardness because concurrent hardness measurements were not available for most of the metal analyses.

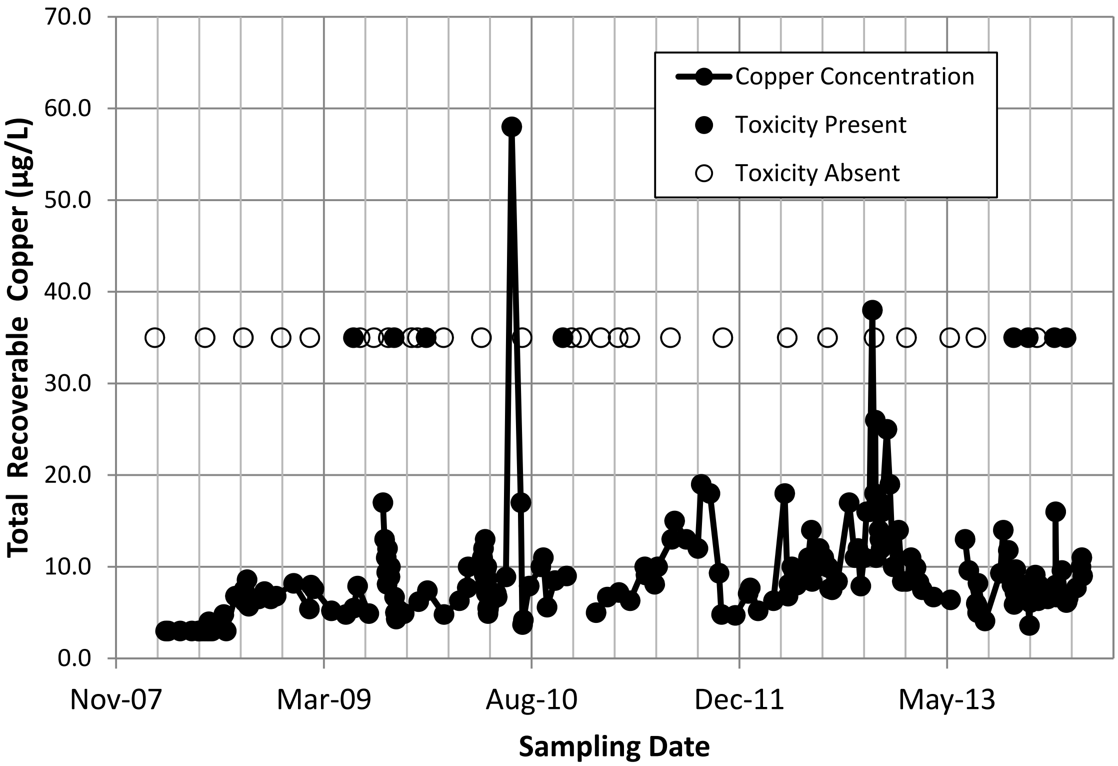

Figure A.1. Plot of Cu concentrations and episodes of WET toxicity.

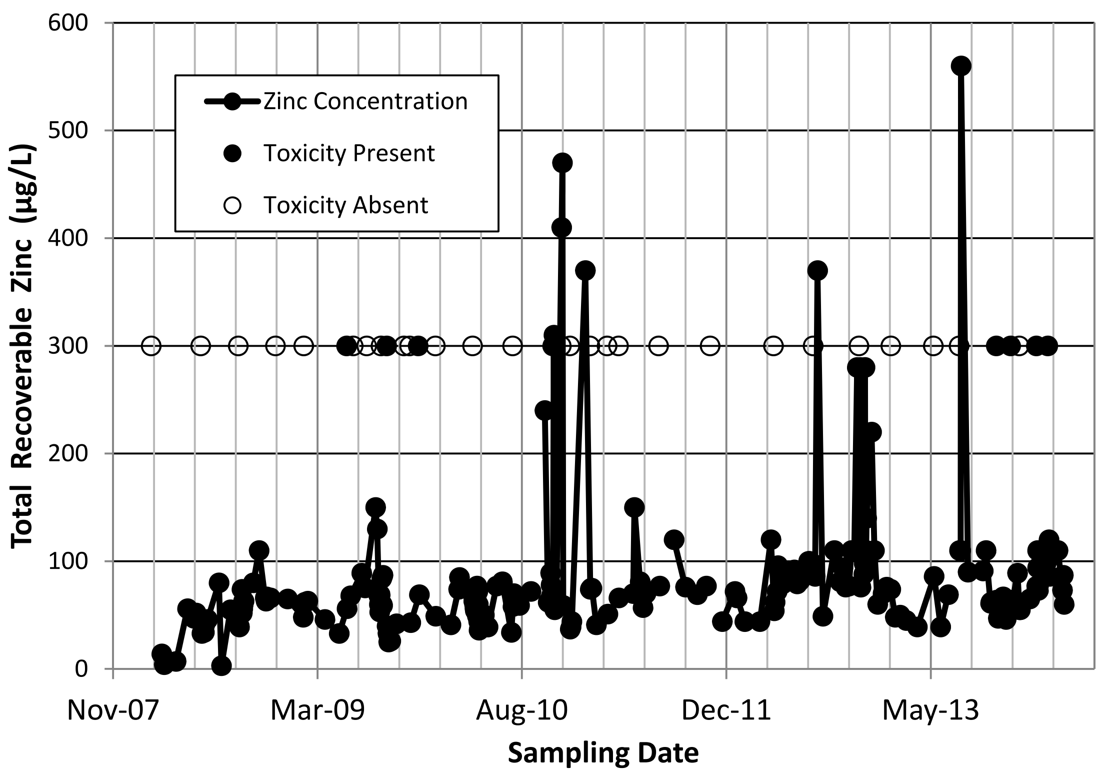

Figure A.2. Plot of Zn concentrations and episodes of WET toxicity.

Hardness measurements from the routine WET tests averaged 68.9 mg/L with a coefficient of variation (%CV) of 13.7%, which indicates that approximately two-thirds of the hardness measurements were within approximately 14% of the average value. Therefore, these hardness values are comparable for the purposes of this analysis. Visual examination of Figures A.1 and A.2 indicates that episodes of WET toxicity did not occur during periods of elevated Cu or Zn concentrations (as total recoverable metal.)

4.0 METAL CONCENTRATIONS IN TEST EXPOSURES

This analysis focused on the tests conducted during the most recent year of testing. Results of quarterly biomonitoring and associated retests are summarized in Tables A.2 and A.3. Visual examination of Table A.2 indicates that three of the four tests showing toxicity also showed strongly non-monotonic dose-response. That is, survival decreased as much or more at lower effluent concentrations as it did at higher effluent concentrations. Interpretation of results such as these is typically difficult and was further complicated in this case by the use of three composite samples to complete the tests, potentially exposing the test organisms to varying toxicant concentrations and sample matrices.

Table A.2. Percent survival at the end of the test in routine chronic WET tests using *C. dubia.*

Percent Effluent	Date of First Sample Collection							
	02/16/14	**01/19/14**	**12/08/13**	**11/17/13**	**10/13/13**	**07/14/13**	**05/12/13**	**01/28/13**
Control	100	100	100	100	100	100	100	100
32	60*	90	80	30*	30*	80	100	100
42	60*	90	90	30*	40*	90	100	100
56	40*	80	100	30*	50*	90	100	100
75	60*	80	90	70	40*	90	100	100
100	40*	60*	100	50*	50*	100	100	100

*Significantly less than the control (one-tailed P < 0.05).

Table A.3. Average neonate production at the end of the test in routine chronic WET tests using *C. dubia.*

Percent Effluent	**Date of First Sample Collection**							
	02/16/14	**01/19/14**	**12/08/13**	**11/17/13**	**10/13/13**	**07/14/13**	**05/12/13**	**01/28/13**
Control	17.9	25.8	24.6	19.4	21.0	28.5	18.5	19.6
32	*	17.6	23.3	*	*	29.8	19.2	23.0
42	*	21.6	27.2	*	*	31.0	22.1	21.8
56	*	17.7	28.3	*	*	32.1	24.0	23.7
75	*	22.2	28.2	*	*	32.1	21.5	24.4
100	*	*	30.6	*	*	34.2	20.6	20.3

*Average neonate production not calculated due to significant mortality in test concentration.

Visual examination of the daily survival in each test indicated that in the three tests showing the most toxicity (sampling periods beginning on 02/16/2014, 11/17/2013, and 10/13/2013), at least half of the total mortality that occurred during the test occurred in the first 48 hours (Table A.4). The test showing the least amount of total mortality occurring within the first 48 hours (30%), which was associated with the sampling period beginning 01/19/2013, showed only marginally significant mortality overall (40%). Therefore, in the tests showing toxicity, most of the toxic effects were acute lethal effects caused by a single sample—that is, the first of the three composite samples used to complete the tests. Based on these results, chronic test data can be interpreted using only the portion of the data that addressed acute toxicity (i.e., toxicity observed during the first 48 hours of the tests). The data include measured hardness and metal concentrations which allowed comparison of calculated hardness-normalized metal concentrations for each test exposure with the biological effect (i.e., percent mortality at 48 hours) at each exposure. For this analysis, hardness-adjusted metal (Cu and Zn) concentrations in each test dilution were estimated based the measured hardness of the effluent, the measured hardness of the dilution water, measured metal concentrations in the effluent[1], and the dilution factor. These results are presented in Table A.5.

[1] Cu and Zn concentrations in the dilution water were assumed to be 0.01 and 0.1 µg/L, respectively.

Table A.4. Percent of total test mortality occurring by 48 hours in routine chronic WET tests that showed significant lethal toxicity.

Date of First Sample Collection	Percent of Total Test Mortality Occurring by 48 Hours
02/16/2014	79
01/19/2014	30
11/17/2013	83
10/13/2013	60

Table A.5. Survival and metal concentrations from chronic biomonitoring tests used to prepare Figures A.3 and A.4.

Sample Collection Date	Toxicity Test Exposure (% Effluent)	% Survival at 48 hours	Hardness[a,b]	Total Metal Concentration (µg/L)			
				Unadjusted [c,d]		Hardness-Adjusted	
				Copper	Zinc	Copper	Zinc
02/16/2014	Control	100	90.0	0.01	0.1	NA	NA
	32	70	80.7	1.95	35.2	1.24	23.5
	42	60	77.8	2.56	46.2	1.69	31.8
	56	40	73.8	3.42	61.6	2.37	44.3
	75	70	68.2	4.58	82.5	3.41	63.4
	100	70	61.0	6.10	110.0	5.06	92.9
01/19/2014	Control	100	60.0	0.01	0.1	NA	NA
	32	100	60.0	2.69	24.3	1.84	17.3
	42	90	60.0	3.53	31.9	2.48	23.2
	56	90	60.0	4.70	42.6	3.44	32.1
	75	90	60.0	6.30	57.0	4.88	45.3
	100	100	60.0	8.40	76.0	7.07	65.1
11/17/2013	Control	100	82.0	0.01	0.1	NA	NA
	32	50	79.8	2.14	21.4	1.38	14.4
	42	50	79.1	2.81	28.1	1.83	19.1
	56	60	78.1	3.75	37.5	2.47	25.7
	75	90	76.8	5.03	50.3	3.36	34.9
	100	80	75.0	6.70	67.0	4.57	47.5
10/13/2013	Control	100	63.0	0.01	0.1	NA	NA
	32	40	68.4	1.89	20.5	1.10	12.6
	42	50	70.1	2.48	26.9	1.46	16.7
	56	60	72.5	3.30	35.8	1.99	22.7
	75	50	75.8	4.43	48.0	2.74	31.2
	100	60	80.0	5.90	64.0	3.79	43.0

Notes:
a. Measured hardness in control and in 100% effluent.
b. Dilution hardness calculated based on dilution factor and measured hardness values in control and 100% effluent.
c. Measured metal concentrations in 100% effluent; control concentrations of Cu and Zn assumed to be 0.01 and 0.1 µg/L, respectively.
d. Metal concentrations in toxicity test exposures were calculated based on dilution factor multiplied times measured metal concentrations in 100% effluent (dilution water and lab control concentrations were assumed; see note c).

The results provided in Table A.5 were used to prepare the plots shown on Figures A.3 and A.4, which illustrate dose-response relationships for Cu and Zn, respectively. Also plotted on Figures A.3 and A.4 are the 48-hour survival data and metal concentrations from WER testing. The WER test results for Cu on Figure A.3 were taken from the tests reported in the main text of this document. The Cu WER data plotted on Figure A.3 are provided in Table A.6 and the Zn data plotted on Figure A.4 are provided in Table A.7. On Figure A.3, the expected dose-response for Cu in the Outfall 001 matrix is indicated by the WER data (solid data points) because the WER test data are from spiked Cu exposures and clearly reflect the effect of Cu on survival in the Outfall 001 matrix. Visual examination of Figure A.3 reveals that the data points for the routine biomonitoring tests (open circles) indicate reductions in survival at Cu concentrations that are an order of magnitude lower than the Cu concentrations causing biological effects in the WER tests. Furthermore, the left-hand portion of the plot indicates that Cu concentrations in exposures showing reduced survival were well within the range of concentrations in exposures showing no reduction in survival.

A similar analysis for Zn is presented on Figure A.4 based on data provided in Tables A.5 and A.7. The WER test data shown in Table A.7 are from a separate study (not discussed herein) to estimate the Zn WER for Outfall 001. A comparison of the level of biological effect between the Zn-spiked WER test exposures (solid data points) and routine biomonitoring (open circles) on Figure A.4 shows reduced survival in the biomonitoring tests at Zn concentrations that are an order of magnitude lower that the Zn concentrations causing biological effects in the WER tests. As with the Cu data set, the left-hand portion of the plot indicates that Zn concentrations in exposures showing reduced survival were well within the range of concentrations in exposures showing no reduction in survival.

Both the Cu and Zn data sets show that there is no correlation between metal concentrations and reduced survival among test exposures and that metal concentrations in the routine biomonitoring tests are well below the range of metal concentrations that would be expected to cause reduced survival in the Outfall 001 matrix.

Table A.6. Data from Cu WER tests used to prepare Figure A.3.

08/05-06/2013, Hardness = 64 mg/L			09/29-30/2013, Hardness = 70 mg/L		
Total Cu Concentration (µg/L)		Percent Survival at 48 Hours	Total Cu Concentration (µg/L)		Percent Survival at 48 Hours
Measured	Hardness-Adjusted		Measured	Hardness-Adjusted	
4.24	3.36	100	7.79	5.68	100
22.4	17.8	100	26.9	19.6	100
34.7	27.5	100	40.7	29.6	100
50.85	40.3	100	58.3	42.4	100
81.1	64.3	75	88.7	64.6	100
131.5	104	0	141	103	95
225	178	0	227	166	0

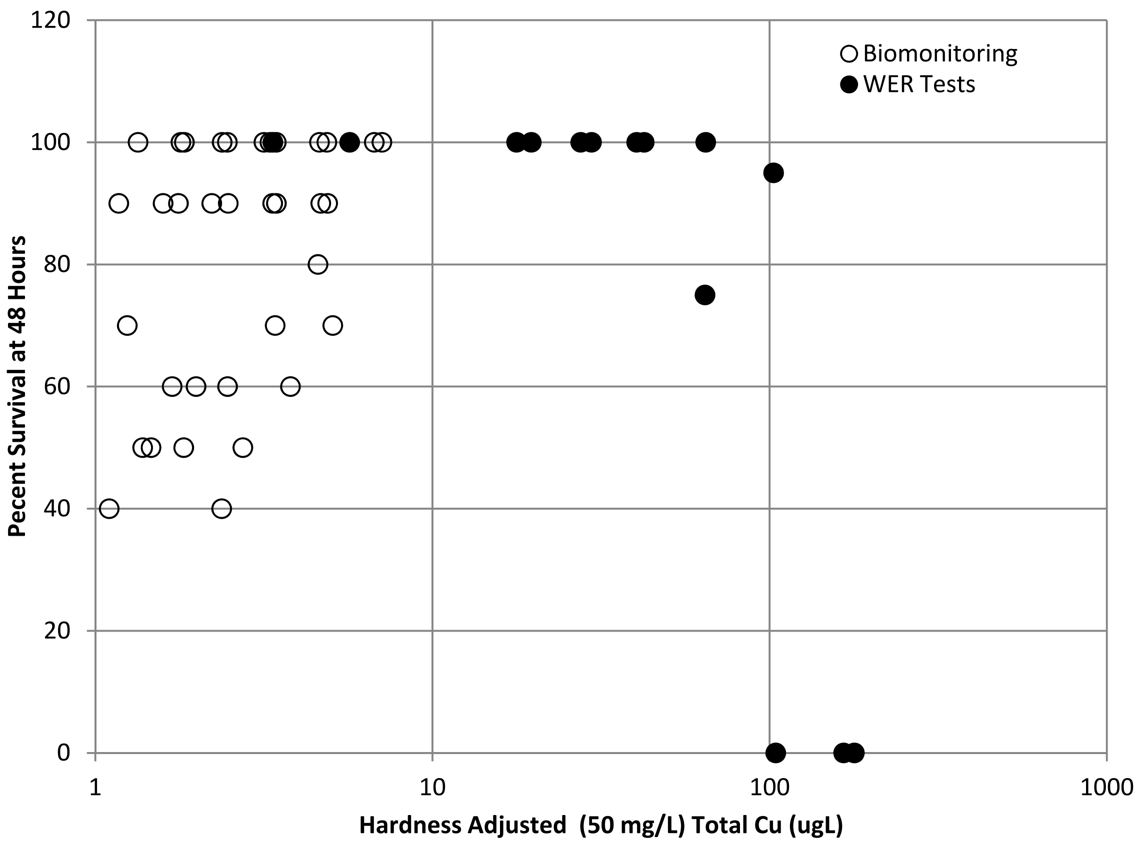

Figure A.3. Hardness-adjusted Cu concentrations vs. percent survival in chronic biomonitoring and acute WER tests using *C. dubia*.

Table A.7. Data from Zn WER tests used to prepare Figure A.4.

09/29-30/2013, Hardness = 70 mg/L			01/29-30/2014, Hardness = 42.7 mg/L		
Total Zn Concentration (µg/L)		Percent Survival at 48 Hours	Total Zn Concentration (µg/L)		Percent Survival at 48 Hours
Measured	Hardness-Adjusted		Measured	Hardness-Adjusted	
86.0	64.7	100	130.0	148.6	100
98.5	74.1	100	140.0	160.0	100
134.5	101.1	100	162.5	185.8	90
170.5	128.2	90	197.0	225.2	55
249.5	187.6	0	254.5	290.9	0

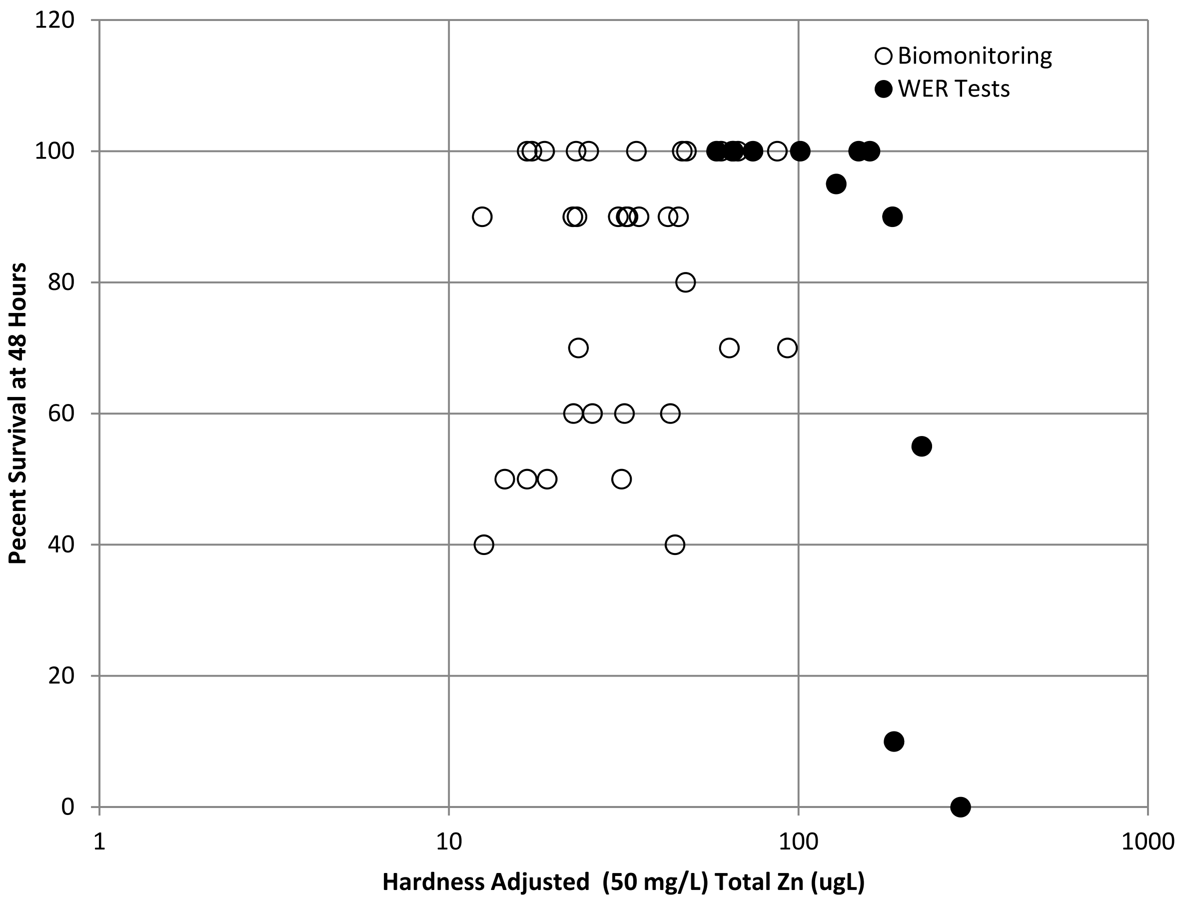

Figure A.4. Hardness-adjusted Zn concentrations vs. percent survival in chronic biomonitoring and acute WER tests using *C. dubia*.

5.0 NON-ADDITIVE (SYNERGISTIC) EFFECTS

Although the toxic effects observed in routine biomonitoring tests are clearly not attributable to the individual action of either Cu or Zn, it is possible, at least in principle (Kamo and Nagai 2008) , that the effects are due to a synergistic interaction between as Cu and Zn. To account for the results reported herein, this interaction would need to be sufficiently strong to account for approximately an order of magnitude increase in the toxicity of one metal due to the presence of another. Interactions of this sort between toxicants as common as Cu and Zn should be well documented in the scientific literature. Preston et al (2000) observed strong synergistic effects between Zn and Cu on toxicity to the bacteria *Escherichia coli* and *Pseudomonas fluorescens.* However, because of the test conditions and endpoints (Ambient pH = 5.5, 20 minute exposures, mg/L-level exposure concentrations) and the test organisms used (bacteria), these results should not be applied to interpret the results provided herein. Spehar and Fiandt (1986) examined the effect of mixtures of Cu, aresenic (As), cadmium (Cd) , chromium (Cr), mercury (Hg) and lead (Pb) on toxicity to *C. dubia* in 7-day chronic tests and concluded that the chronic toxicity of these metals was "strictly additive". Mahar and Watzin (2005) evaluated the effects of Cu, Zn and diazinon mixtures on toxicity to *C. dubia* in 7-day chronic tests and found that mixture toxicity was additive or less than additive in all toxicant combinations including Cu + Zn without diazinon. Although this literature review is not exhaustive, it suggests that synergistic interactions between Cu and Zn that would account for the biomonitoring results reported herein are unlikely except under markedly different test protocols.

6.0 CONCLUSIONS

The objective of this evaluation was to demonstrate whether or not observed levels and patterns of toxicity are consistent with levels and patterns of Cu and Zn concentrations. The evaluation found the following:

1. Episodes of toxicity in routine biomonitoring test did not co-occur with elevated Cu or Zn concentrations (Figures A.1 and A.2),
2. Metal concentrations in routine biomonitoring were an order of magnitude below the levels that spiked effluent tests demonstrated were necessary to cause reduced survival in 48-hour exposures, and

3. Metal concentrations in test exposures showing toxicity (reduced survival) were well within the range of concentrations in exposures showing no toxicity.
4. Based on published literature, synergistic interactions between Cu and Zn are an unlikely cause of toxicity observed in routine biomonitoring.

These findings indicate no correlation between elevated Cu or Zn concentrations and toxicity either among or within routine biomonitoring tests. Since the presence of a correlation between toxicant and response (i.e., a dose-response) is a necessary (but not sufficient) condition for establishing cause and effect, episodes of toxicity in routine biomonitoring at Outfall 001 are not due to the presence of Cu or Zn in toxic concentrations. Therefore, episodes of toxicity up to this point should not preclude development or implementation of a WER.

7.0 LITERATURE CITED

Kamo N and T Nagai. An application of the biotic ligand model to predict the toxic effects of metal mixtures. Environ. Toxicol. Chem. 27: 1479-1487.

Mahar AM and MC Watzin. 2005. effects of metal and organophosphate mixtures on *Ceriodaphnia dubia* survival and reproduction. Environ. Toxicol. Chem. 24:1579-1586.

Preston S, N Coad, J Townend, K Killham, GI Paton. 2000. Biosensing the acute toxicity of metal interactions: are they additive, synergistic or agonistic?. Environ. Toxicol. Chem. 19:775-780.

Spehar RL and JT Fiandt. 1986. Acute and chronic mixtures of water quality criteria-based metal mixtures on three aqautic species. Environ. Toxicol. Chem. 5:917-931

APPENDIX B

ADEQ Pretreatment Audit Report

ADEQ
ARKANSAS
Department of Environmental Quality

July 10, 2012

Gary Smith, Director of Utilities
City of Van Buren
P O Box 1269
Van Buren, AR 72956

Re: City of Van Buren (AFIN: 17-00062 NPDES Permit Number: AR0021482)
Pretreatment Program Audit & Municipal Pollution Prevention (P2) Assessment

Dear Mr. Smith:

Please find enclosed the finished report for the audit/assessment conducted by the Department from June 19th through 21st, 2012. The report should be made available for review by appropriate industrial and City officials. The Van Buren staff should discuss and evaluate the findings in this report. Please respond to the required actions and recommendations in writing within thirty (30) days.

The Department appreciates the staff's assistance. The staff appeared very interested in both the Pretreatment and Pollution Prevention Programs. Most of the recommendations in the attached audit/assessment are intended to aide the City's pretreatment program with achieving the objectives of the Clean Water Act.

If the City has questions or concerns, please do not hesitate to contact the Department at (501) 682-0626 or torrence@adeq.state.ar.us .

Sincerely,

Rufus J. Torrence

Rufus J. Torrence, Water Division Engineer

Encl: Audit Report/Assessment Checklist

Cc: Rudy Molinda / EPA 6WQ-PM (via e-mail w/o attmt)
Eric Fleming / Mgr-Field Services (w/o attmt)

PRETREATMENT PROGRAM AUDIT/

POLLUTION PREVENTION ASSESSMENT

CITY OF VAN BUREN, ARKANSAS

NPDES PERMIT #AR0021482

July 10, 2012

PREPARED BY: Rufus Torrence

ADEQ Water Division Engineer and Auditor

ARKANSAS DEPARTMENT OF ENVIRONMENTAL QUALITY

5301 Northshore Drive

NORTH LITTLE ROCK, ARKANSAS 72118-5317

Van Buren's Pretreatment Program was originally approved 10/1/81. Subsequent modifications were submitted, approved and incorporated into the City's NPDES permit on 3/21/90, on 3/6/97 and recently on 3/18/2011. These modifications included changes in the City's Pretreatment Ordinance, headworks loading evaluation and minor program narrative revisions. The City recently updated the pretreatment program to comply with the recent revisions to 40 CFR Part 403. These revisions are commonly referred to as the "Streamlining" updates.

The City has three (3) wastewater treatment plants. The main (South) POTW design flow was increased to 4.0 MGD. The South Plant has a screening unit, two 60' diameter secondary clarifiers, UV disinfection unit, flow monitoring equipment, and standby power source. The old aerated lagoon was modified to an activated sludge unit consisting of two aerated basins (combined surface area of 56,292 square feet), aerobic sludge storage (surface area of 46,354 square feet), and an equalization basin (surface area 167,777 square feet). Eight (8) significant (four are categorical) industrial users (SIUs) contribute about 0.70 millions gallons each day to the POTW. The South POTW discharges into the Arkansas River. The POTW effluent has exhibited no toxicity to aquatic life. Constructing and upgrading the plant, the City dredged the lagoon and land applied the sludge in July 2008 on nearby City-owned property. The sludge had low metal content (Copper at 13 mg/kg and Zinc at 54 mg/kg).

The Lee Creek POTW is a simple activated sludge package treatment plant operating under extended aeration conditions. This POTW design flow is 0.04 MGD. The POTW has no significant industrial user contributions and accepts only sanitary wastewater from Bekaert Steel, a nearby ball park and an I-40 rest area. The POTW treated effluent is chlorine disinfected and discharged to the Arkansas River. Accumulated sludge is wasted to an aerated holding digester and periodically transported to the North POTW.

The North POTW is a closed loop reactor, has a 2 channel orbal design, and has an oxidation ditch with 2 stage clarification. A non-categorical SIU contributes about 10,000 gallons each day to the POTW. The POTW design flow is 2.0 MGD and discharges to Lee Creek. The POTW effluent is disinfected in a UV contact chamber and discharged to the creek. The POTW effluent has exhibited no toxicity to aquatic life. Biosolids are periodically dredged and land applied on City property.

Effective on 3-1-11, the North Plant has permit limits for Copper (9.2 μg/l) and Zinc (85.5 μg/l). Monitoring results submitted to ADEQ indicate a pattern of violations for both metals. Since the North plant has only one significant industrial user (Arkansas Valley Truck Wash), the source of the metals appear to be from domestic users. The City should be aware that the pretreatment program will probably not be placed in SNC (significant noncompliance) for pass through ("pass through" is limited to non-domestic sources) if the North plant continues to violate the effluent metal limits. However, ADEQ enforcement has expressed concerns for violating the NPDES permit limits (See Attachment I-1/3 for more details).

The audit/assessment consisted of informal discussions with the City's Pretreatment Coordinator, examination of industrial user files, pretreatment records and site visits to five (5) industrial users. The auditor utilized a checklist to ensure that all facets of the program were evaluated. A copy of the completed checklist is attached. Additional information obtained during the audit is included as Attachments

The report is divided into three sections. Section B provides a summary of the significant findings of the audit which will require action by the City. Section C includes recommendations to help improve the implementation and enforcement of their Pretreatment and Pollution Prevention Programs. Finally, required program modifications to the City's approved program, including its adopted legal authorities, are outlined in Section D.

B) SUMMARY OF FINDINGS WITH REQUIRED ACTIONS

This section of the report is a summary of deficiencies found in the City of Van Buren's Pretreatment Program. The auditor has paraphrased with CFR citations the actions required by the City to comply with the current General Pretreatment Regulations (40 CFR 403) and with the approved program. A narrative explanation of the finding will follow the citations.

1) Under ***40 CFR Part 408.5(f)(4)*** find "*The POTW shall develop local limits as required in §403.5(c)(1), or demonstrate that they are not necessary.*

The City's North plant has permit limits for Copper (9.2 ug/l) and Zinc (85.5 ug/l) which became effective on March 1, 2011. The permit limits are included to prevent pass through to the receiving stream (Lee Creek). The Copper and Zinc in the North plant effluent are consistently higher than WQS for the receiving stream and, hence, the plant is consistently in violation of the NPDES permit limits for Copper and Zinc. The North plant is not designed to remove Copper or Zinc.

The North plant has only one significant industrial user. The metals in the influent appear to originate from domestic sources (see Attachment L-6/14) as the metal levels in the influent are typical for domestic wastewater. Local limits apply to non-domestic sources only. ADEQ has provided the City with guidance (see Attachment K-1/6) which indicates that local limits for toxic and conventional pollutants are not necessary for the City's two main POTWs. Nonetheless, the City has a <u>Duty to Comply</u> with the NPDES permit limits and must take steps to remedy the violations. In a letter dated March 13, 2012, the Department required the City to work toward compliance (see Attachment I-1/3). Finally, the City must either develop local limits for all pollutants of concern or confirm that local limits are not necessary (see Recommendation #1 & #4 below for more details).

C) RECOMMENDED POTW ACTIONS FOR IMPROVED IMPLEMENTATION OF THE PRETREATMENT AND POLLUTION PREVENTION PROGRAMS

1) The Department will not require the City to develop local limits at this time. Based on the influent loading data shown in Attachment K-3/6, the conventional pollutant loadings to the South average only about half of the design capacity. Since the metals enter the South and North plant at domestic levels, local limits for metals at both plants appear unnecessary. However, the Department recommends that the City develop local limits for at least $CBOD_5$ and TSS for the South Plant. Referring to Attachments L-6/14 and L-9/14, the City has demonstrated that local limits are not necessary for Arsenic, Cadmium, Chromium, Copper, Cyanide, Lead, Mercury, Nickel, Selenium, Silver and Zinc as these pollutants enter the POTW below EPA Typical Domestic Levels. The City has no point source for Ammonia.

2) River City Coating permit has a fact sheet which shows the derivation of mass limits. The previous permit had mass limits. Since the present permit does not have mass limits, the City should remove the derivation from the fact sheet. See Attachment F-3/3 for details.

3) The City should consider developing a Water Effect Ratio (WER) for Copper and Zinc for the North Plant. The North Plant is consistently violating the permit limits for Copper and Zinc. A WER greater than 1 will increase the permit limits for Copper and Zinc. The Department has provided the City with guidance and contact information.

4) The South Plant occasionally violates the NPDES permit limits for ammonia. Since the City does not have a point source for ammonia, a local limit for ammonia will not remedy the violations. However, the City can request assistance from point sources of CBOD.

The City influent flow varies considerably over the course of a week. The variation in flow appears to follow the pattern of discharger from the three main hydraulic dischargers (Simmons Poultry, Simmons Food and Tyson Food). The City should consider coordinating the discharges from these three SIUs to level the influent flow and CBOD loading. A steady organic loading may assist the plant with nitrification and dinitrification.

5) Since the Metal Finishers are not significant sources of organic loading, the City should consider removing the BOD and TSS limits from these permits.

APPENDIX C

Study Plan for Copper WER Development

water resources / environmental consultants

WORK PLAN TO DEVELOP A SITE-SPECIFIC CRITERION FOR COPPER BASED ON A WATER-EFFECTS RATIO

VAN BUREN NORTH TREATMENT PLANT NPDES PERMIT NO. AR0040967

FINAL
SEPTEMBER 15, 2014

WORK PLAN TO DEVELOP
A SITE-SPECIFIC CRITERION FOR COPPER
BASED ON A WATER-EFFECTS RATIO

VAN BUREN NORTH TREATMENT PLANT
NPDES PERMIT NO. AR0040967

Prepared for

Arkansas Department of Environmental Quality
5301 Northshore Drive
North Little Rock, AR 72118

Submitted by

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Van Buren North Treatment Plant
2806 Bryan Road
PO Box 1269
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Prepared by

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3 Innwood Circle, Suite 220
Little Rock, AR 72211

FTN No. 04335-0001-001

FINAL
September 15, 2014

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1.0 INTRODUCTION

The purpose of this document is to present a work plan for conducting a water-effects ratio (WER) study for Outfall 001 of the Van Buren North Treatment Plant located in Van Buren, Arkansas (National Pollutant Discharge Elimination System [NPDES] Permit No. AR0040967) and operated by Van Buren Municipal Utilities (VBMU). The WER study is being proposed as provided in Arkansas Pollution Control and Ecology Commission (APCEC) Regulation No. 2, *Regulation Establishing Water Quality Standards for Surface Waters of the State of Arkansas* (2011). Section 2.308 of Regulation No. 2 allows alternative chemical-specific water quality criteria (WQC) that reflect site-specific conditions. This plan has been revised per written comments received from the Arkansas Department of Environmental Quality (ADEQ) on 2/26/2014, and the Environmental Protection Agency (EPA) on 6/13/2014. This document incorporates all changes requested by both ADEQ and EPA.

The objective of this study is to develop a WER is to support a site-specific water quality criterion for copper (Cu) in Reach 002 of Lee Creek. It is part of a concurent study which is being addressed in a separate document to develop a WER-based site specific criterion for zinc (Zn). The technical approach to develop the Cu WER (discussed more fully in Sections 1.6 and 2.0) will follow the Streamlined Procedure (EPA 2001). The technical approach for the Zn WER will follow the Interim Procedure (EPA 1994) because the Streamlined Procedure does not apply to Zn.

1.1 Options Considered

Options that VBMU considered towards achieving compliance with its NPDES permit limit for Cu were a site-specific criterion, treatment, source control and permit modification to classify Outfall 001 as a discharge to the Arkansas River.

VBMU conducted an evaluation of the sanitary waste collection system in an attempt to identify sources that could be targeted to control influent Cu concentrations. This evaluation (Appendix A) could not identify specific discreet sources of Cu on which to focus source control and concluded that Cu loading to the plant is from domestic sources.

There is a wide range of known or potential treatment technologies that could, in principle, be implemented as part of the VBMU treatment. In general, however, only precipitation/flocculation technologies are feasible at an industrial scale as would be required for the VBMU North Plant (Blais et al, 2008). While this technology is adequate to reduce wastewater metal concentrations to ~0.5 mg/L levels, it is not adequate to consistently acheive the additional 2 orders of magnitude removal required to attain Cu concentrations < 10 µg/L (Lankford, 1990).

VBMU also considered the possibility of reclassifying Outfall 001as a discharge to the Arkansas River. Arkansas Department of Environmental Quality (ADEQ) rejected VBMU's technical rational for a permit modification based on such a reclassification.

In its Pretreatment Program Audit and Municipal Pollution Prevention Assessment (Appendix B), ADEQ staff recommended that "The City should consider developing a WER for Cu and Zn for the North Plant. The North Plant is consistently violating the permit limits for Cu and Zn. A WER greater than 1 will increase the permit limits for Cu and Zn. The Department has provided the City with guidance and contact information." Accordingly, VBMU is proposing the study described herein to provide justification for a site-specific criterion for Cu in the portion of Reach 002 of Lee Creek from the edge of the mixing zone with the Arkansas River to VBMU's permitted outfall in Crawford County. This approach would involve modification of Arkansas' Regulation No. 2 through a third party rulemaking.

1.2 Receiving Stream

Per page 2, Item #6 in the Fact Sheet of AR0040967 Outfall 001 discharges into the Arkansas River via Lee Creek in Segment 3H of the Arkansas River Basin. The receiving stream with US Geological Survey (USGS) 8-digit hydrologic unit code (HUC) 11110104 and Reach No. 002 is a water of the state classified for primary contact recreation; raw water source for public, industrial, and agricultural water supplies; propagation of desirable species of fish and other aquatic life; and other compatible uses. The reaches of Lee Creek and the Arkansas River that receive the discharge are not listed on the revised 2012 Arkansas 303(d) list of water quality-limited waterbodies.

1.3 Facility Process Description

The facility has a design flow of 2.0 million gallons per day (MGD) and treats municipal waste. Treatment includes bar screens, three individual oxidation ditches with the final clarifiers operated in parallel, followed by UV disinfection. At any time all or any combination of the three systems can be operated.

An equalization pond is used during wet weather conditions to reduce flow during or following storm events. The amount diverted to the surge pond depends on the amount needed to keep the effluent flow below 2.0 MGD, or an amount that can be treated. The equalization pond may also be used to reduce flows through the plant to prevent solids wash-out from clogged return telescope valves and for maintenance purposes. All water diverted through the equalization pond is eventually pumped through the treatment system. All diversions are controlled by manual valves.

1.4 Discharge Characteristics

Permit limits for the existing NPDES permit are provided in Table 1.1. The discharge routinely exceeds NPDES permit limits for Cu, which have a 7-day average limit of 18.5 µg/L and a monthly average limit of 9.2 µg/L. The existing Cu limits are based on the state's water quality criteria for Cu (APCEC 2011), which are, in turn, based on the national criteria. Discharge characteristics (including biomonitoring), as indicated by routine discharge monitoring reports (DMRs), are summarized in Tables 1.2 and 1.3. Under the present permit (Effective March 1, 2008) there have been four whole effluent toxicity (WET) test excursions in routine biomonitoring (Table 1.2).[1] Persistent toxicity was never identified in the required retesting. Figure 1.1 shows a time series plot of Cu concentrations with an indication of the timing of WET excursions. VBMU generally collects samples for Cu analyses as part of the second composite sample collected for chronic biomonitoring tests. Therefore the data points for Cu concentrations and WET analyses in Figure 1.1 represent concurrent measurements. The plot shows that WET excursions did not occur during periods of relatively high Cu concentrations.

[1] This table was current at the time of the original submission of this plan for agency review (March 4, 2013). A complete analysis of WET test results and other DMR monitoring will be provided as part of the documentation supporting the site-specific criterion.

A summary of exceedance factors (measured Cu concentration ÷ permit limit) for recent (January 2010 through December 2012) routine monitoring data is presented in Table 1.4. The 95th percentile values for the exceedance factors corresponding to the monthly average and weekly average permit limits are 2.1 and 1.0, respectively. This result indicates that the existing monthly average permit limit for Cu needs to be increased by a factor of approximately 2.1 to result in permit compliance.

This monitoring indicates that:

1. Cu and Zn concentration exceed effluent limitations;
2. The discharge is in general compliance with its permit on other parameters;
3. The discharge has not shown toxicity at the critical dilution (100%) since October 2010, (see footnote 1); and
4. Previous episodes of toxicity do not correspond to periods of elevated Cu concentrations.

Table 1.1. Current NPDES permit discharge limits for Outfall 001.

Effluent Characteristics	Discharge Limitations (mg/L, unless otherwise specified) Monthly Average	7-day Average
Flow	N/A	Report
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$) May – October November – April	 10.0 20.0	 15.0 30.0
Total Suspended Solids (TSS) May – October November – April	15.0 20.0	22.5 30.0
Ammonia Nitrogen April May – October November – March	2.2 2.0 4.0	5.6 3.0 6.0
Dissolved Oxygen May – October November – April	5.0 (Monthly Average Minimum) 6.0 (Monthly Average Minimum)	
Fecal Coliform Bacteria (FCB) April – September October – March	200 colony-forming units (CFU)/100mL 1,000 CFU/100mL	400 CFU/100mL 2,000 CFU/100mL
Copper, Total Recoverable	9.2 µg/L	18.5 µg/L
Zinc, Total Recoverable	85.5 µg/L	171.6 µg/L
pH	<u>Minimum</u>: 6.0 su	<u>Maximum</u>: 9.0 su
Pimephales promelas **(Chronic)**	**7-day Average**	
Pass/Fail Lethality (7-day NOEC)	Report (Pass/Fail)	
Pass/Fail Growth (7-day NOEC)	Report (Pass/Fail)	
Survival (7-day NOEC)	Report %	
Coefficient of Variation	Report %	
Reproduction (7-day NOEC)	Report %	
Ceriodaphnia dubia **(Chronic)**	**7-day Average**	
Pass/Fail Lethality (7-day NOEC)	Report (Pass/Fail)	
Pass/Fail Growth (7-day NOEC)	Report (Pass/Fail)	
Survival (7-day NOEC)	Report %	
Coefficient of Variation	Report %	
Reproduction (7-day NOEC)	Report %	

Table 1.2. Summary of NOEC (% effluent) from the most recent 3 years of routine biomonitoring at the Van Buren North Treatment Plant Outfall 001.

	P. promelas		*C. dubia*	
Sampling Dates	**Survival**	**Growth**	**Survival**	**Reproduction**
11/11/12-11/15/2012	100	100	100	100
7/22/12-7/26/2012	100	100	100	100
04/15/12 – 04/19/12	100	100	100	100
01/15/12-01/19/12	100	100	100	100
11/13/11-11/17/11	100	100	100	100
07/10/11-07/14/11	100	100	100	100
04/03/11-04/07/11	100	100	100	100
03/06/11-03/10/11	No Test	No Test	100	100
01/23/11-01/27/11	100	100	Control Failure	Control Failure
12/05/10-12/09/10	No Test	No Test	100	100
11/14/10-11/18/10	100	100	100	100
10/24/10-10/28/10	100	100	100	< 100
07/18/10-07/22/10	100	100	100	100
04/11/10-04/15/10	100	100	100	100
01/10/10-01/14/10	100	100	100	100
11/29/09-12/03/09	100	100	< 100	< 100
11/08/09-11/12/09	100	100	100	100
10/25/09-10/29/09	100	100	100	100
09/13/09-09/17/09	< 100	< 100	100	< 100
08/30/09-09/03/09	No Test	No Test	100	100
07/26/09-07/30/09	No Test	No Test	100	100
06/23/09-06/28/09	No Test	No Test	100	100
06/07/09-06/11/09	100	100	100	< 100
02/22/09-02/26/09	100	100	100	100

Table 1.3. Summary of DMR monitoring at Outfall 001,October 2009 through September 2012.

Summary Statistic		Avg Flow (mgd)	Max Flow (mgd)	CBOD (mg/L)	TSS (mg/L)	FCB (CFU)	pH (min)	pH (max)	DO (mg/L)	NH_3-N (mg/L)	Cu (µg/L)	Zn (µg/L)
Percentile	25	0.79	1.12	3.5	1.8	4.8	6.1	6.6	7.6	0.11	6.3	48.4
	50	1.02	2.01	4.0	2.4	11	6.2	6.7	8.2	0.17	8.0	69.0
	75	1.36	2.70	4.5	3.0	26	6.2	6.8	9.2	0.24	9.1	84.8
	95	1.91	3.89	7.3	5.2	67	6.3	7.0	9.9	0.60	14	164
Minimum		0.56	0.66	3.0	1.0	1.0	6.1	6.2	6.9	0.05	4.7	40.0
Average		1.12	2.06	4.3	2.6	20	6.2	6.7	8.4	0.23	8.5	79.6
Maximum		2.15	4.94	7.5	5.8	102	6.4	7.1	10.2	0.98	18	249

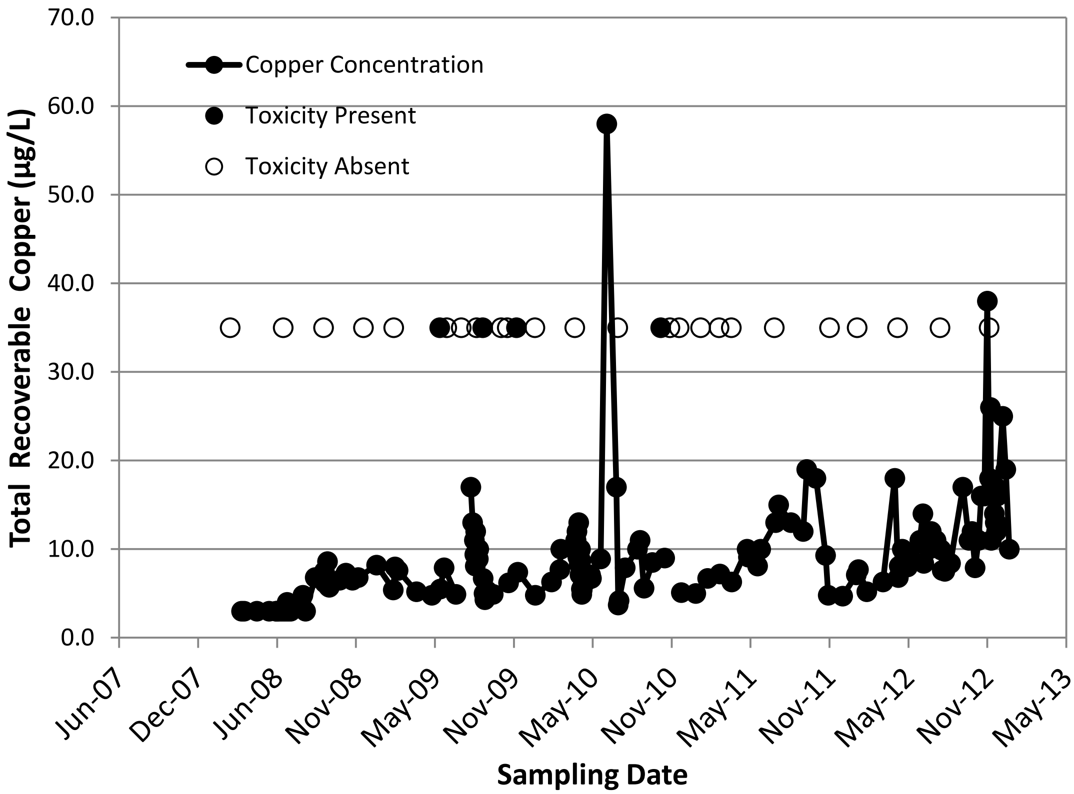

Figure 1.1. Plot of copper concentrations and occurrences of WET excursions.

Table 1.4. Summary of Zn and Cu concentrations and exceedance factors based on Outfall 001 monitoring from January 2010 through December 2012.

Summary Statistic		Copper			Zinc		
		Concentration (µg/L)	Exceedance Factor		Concentration (µg/L)	Exceedance Factor	
			Monthly Average	Weekly Average		Monthly Average	Weekly Average
Pctl*	95	19	2.1	1.0	280	3.3	1.6
	75	12	1.3	0.6	94.5	1.1	0.6
	50	9.9	1.1	0.5	75	0.9	0.4
	25	7.5	0.8	0.4	57.75	0.7	0.3
Minimum		3.7	0.4	0.2	34.0	0.4	0.2
Average		11.1	1.2	0.6	95.7	1.1	0.6
Maximum		58.0	6.3	3.1	470.0	5.5	2.7
Proportion Exceeding Permit Limit			0.56	0.06		0.34	0.09

* Percentile

1.5 Preliminary WER Evaluation

A preliminary evaluation of the expected WER was made using the biotic ligand model (BLM). The BLM (Di Toro et al. 2001) forms the basis for the US Environmental Protection Agency's (EPA's) ambient water quality criterion for Cu (EPA 2007). It predicts Cu toxicity to *Ceriodaphnia dubia* and other standard aquatic test species based on measured concentrations of selected cations (e.g., calcium and magnesium), anions (e.g., chloride and sulfate), alkalinity, pH, and dissolved organic carbon. Measured values of these parameters were obtained from a sample collected on July 1, 2012. The model calculation (Appendix C) indicated an expected WER of 8.6 (Table 1.5). This result suggests that the permit limit could be adjusted upward by a factor of 8.6, based on the predicted bioavailability of Cu in the effluent. Since the BLM predicts a WER of 8.6, raising the permit limit by a factor of 2.1 to achieve permit compliance would allow for a substantial margin of safety.

Table 1.5. Summary of BLM model results.

<table>
<tr><th rowspan="2">Sample</th><th rowspan="2">Hardness
(mg/L as $CaCO_3$)</th><th colspan="2">BLM-Predicted LC50</th><th rowspan="2">Adjusted LC50*
(µg/L)</th><th rowspan="2">Predicted WER
(total copper)</th></tr>
<tr><th>mol/L</th><th>µg/L</th></tr>
<tr><td>Outfall 001</td><td>71.5</td><td>2.38 E-06</td><td></td><td>207.3</td><td>8.6</td></tr>
<tr><td colspan="6">Species Mean Acute Value (SMAV) EC50 (µg/L) from EPA (2001), Appendix B</td></tr>
<tr><th rowspan="2">Species</th><th colspan="3">Hardness = 50 mg/L</th><th colspan="2">Hardness = 100 mg/L</th></tr>
<tr><th>Total Copper
(µg/L)</th><th colspan="2">Dissolved Copper
(µg/L)</th><th>Total Copper
(µg/L)</th><th>Dissolved Copper
(µg/L)</th></tr>
<tr><td>C. dubia</td><td>12.49</td><td colspan="2">11.51</td><td>24.00</td><td>22.11</td></tr>
</table>

*Hardness = 100 mg/L

1.6 Proposed Approach

Technical guidance for conducting a WER study is provided in EPA's Interim Procedure (EPA 1994) and the Streamlined Procedure (EPA 2001). The Interim Procedure applies to all situations for most metals, whereas the Streamlined Procedure applies only to situations where Cu concentrations are elevated primarily by continuous point sources and where Cu in the receiving stream is expected to attain its maximum concentrations under low-flow conditions. The Streamlined Procedure is not intended for situations where wet weather or nonpoint sources are the dominant Cu sources (EPA 2001). Since Lee Creek is not on the 303(d) list of impaired waters it can be presumed that Lee Creek is meeting water quality standards for Cu and that Outfall 001 would represent the major source of Cu in the reach of Lee Creek in question. Accordingly, the Streamlined Procedure provides an appropriate approach for WER development for Outfall 001.

Testing and analysis to develop the WER is part of a concurent study to develop a WER-based site specific criterion for Zn which must follow EPA (1994). Page 135 of EPA (1994) states that when WERs for more than 1 metal are being developed "...one or more toxicity test must be condcuted at the end to show that the combination of all metals at their proposed new site-specific criteria is acceptable." Accordingly, the proposed study will include a toxicity test using the primary test species in effluent spiked to levels of Cu and Zn equal to the proposed criteria.

2.0 SAMPLING AND TESTING PROTOCOL

The following sampling and testing protocol is based on Appendix A of the Streamlined Procedure (EPA 2001). All toxicity test procedures and analytical testing will be conducted by American Interplex Corporation Laboratories[2] (AIC), which is an ADEQ-certified laboratory.

Per the Streamlined Procedure, definitive WER testing as described below will be conducted on two occasions, using samples collected at least 30 days apart.

2.1 Test Organisms

The Streamlined Procedure requires the use of either *C. dubia* or *Daphnia magna* for WER tests. The test organism chosen for this project is *C. dubia*, which is also used in the plant's routine quarterly biomonitoring. Toxicity tests will be conducted using *C. dubia* cultured in "moderately hard" laboratory water (EPA 2002). Recent routine biomonitoring tests indicate an average effluent hardness values of 68 mg/L as $CaCO_3$. In the judgement of the laboratory support personnel and FTN project management, this hardness level is sufficiently similar to the average culture hardness of 84 mg/L to obviate the need for special culture conditions. Therefore, special organism acclimation to site water hardness is not anticipated as part of this project. Test organisms will be less than 24 hours of age and within 8 hours of the same age at the beginning of the test. Test organisms will be fed algae before they are transferred to the test chambers to begin the test. However, no food will be placed in the test containers, and special care will be taken to prevent the transfer of food to the test containers along with the test organisms when the test is loaded.

2.2 Sample Collection

For WER testing, the Streamlined Procedure stipulates the use of a simulated downstream sample prepared by collecting and mixing samples of effluent and upstream water at the design low-flow dilution. The simulated downstream sample is then used for all toxicity

[2] 8600 Kanis Road, Little Rock, AR 72011

testing and associated chemical analyses. The critical dilution for Outfall 001 is 100%. Accordingly, all testing using the site water (effluent) will be performed using undiluted (100%) effluent.

A 24-hour flow-weighted composite effluent sample will be collected using an automated sampler. Sampler bottles will be washed according to AIC Quality Assurance (QA) Plan specifications (detergent-washed, rinsed in acid+deionized water). Samples to be used for toxicity testing will be maintained unpreserved at 1°C to 4°C during collection shipment and storage. The flow-weighted composite sample will be prepared in the laboratory using flow data provided by plant personnel. Sub-samples of the composite will be collected for analysis of chemical parameters using appropriate sample container cleaning and sample preservation. Samples will be stored in the dark at 1°C to 4°C with no headspace in the container.

The effluent sample will be collected at a time when plant operating conditions are average or better, and when the discharge is relatively unaffected by short-term perturbations due to rainfall. The receiving stream flows and weather conditions will be documented based on data for two weeks preceding the sampling event from USGS stream monitoring station (USGS 07250085 [Lee Creek at Lee Creek Reservoir] approximately 1.2 miles upstream of Outfall 001). Normal operating conditions will be documented based on measurements of DMR monitoring parameters listed in Table 1.3 and flows taken during the time of effluent sampling, and then compared with values typical for the plant. Sample delivery to the testing laboratory will include appropriate completed chain-of-custody.

2.3 Laboratory Test Water

Water used in the laboratory water toxicity tests will be prepared per EPA guidance (EPA 2002). The concentration of total organic carbon (TOC) and total suspended solids (TSS) in the laboratory water will be less than 0.5 mg/L and less than 4 mg/L, respectively. The concentration of salts used to prepare the laboratory water will be adjusted to provide a hardness of approximately 100 mg/L. This approach will result in laboratory water with (1) Levels of alkalinity and pH that are appropriate for the level of hardness, (2) A measured hardness concentration between 40 and 220 mg/L, and (3) A level of hardness similar to the site water per requirements of EPA (2001).

2.4 Toxicity Tests

2.4.1 Range-Finding Tests

Range-finding tests will be conducted prior to the conduct of definitive toxicity tests used to calculate the WER. The purpose of the range-finding test is to determine the appropriate range of Cu concentrations for the definitive tests and to indicate whether or not the definitive tests can be conducted as static renewal or static non-renewal tests. The range-finding tests can also provide a preliminary estimate of the WER. Range-finding tests will be conducted on site water and laboratory water spiked with inorganic Cu salts.

The Cu stock solution used to spike the site water and laboratory samples will be prepared from deionized water and reagent-grade Cu chloride 2-hydrate [$CuCl_2(2H_2O)$], Cu nitrate 2.5-hydrate [$Cu(NO_3)_2(2.5H_2O)$], or Cu sulfate 5-hydrate [$CuSO_4(5H_2O)$]. The stock solution will be sufficiently concentrated to prevent significant dilution of the site water or laboratory water with the deionized water matrix. The stock solution will be sufficiently acidified with reagent-grade acid to prevent Cu precipitation during storage, while not containing excess acid that will affect the pH of the test solutions.

Tests will be 48-hour static non-renewal tests, with ten organisms per concentration and up to eight Cu exposure concentrations using a dilution factor of 0.3. Because the purpose of the range-finding test is to determine the appropriate upper and lower range of Cu concentrations for the definitive test, Cu concentrations will not be measured at each exposure concentration. However, initial and final Cu concentrations will be measured at selected concentrations to evaluate the change in Cu concentration occurring in the test beakers during the test. This information will be used to determine the need for static renewals at 24 hours in the definitive tests. Definitive tests will be conducted as static renewal tests if there is greater than a 50% decrease in dissolved Cu concentrations between the initial and final values in the range-finding test, or if an unacceptable decrease in dissolved oxygen occurs in the test beakers.

2.4.2 Definitive Tests

Definitive toxicity tests to be used for the calculation of the WER will be designed based on the results of the range-finding tests. For purposes of preparing this protocol, it is assumed that static non-renewal tests will be required. The procedure for the static renewal test will be essentially identical, except for the intervening renewal step. A dilution factor of at least 0.6 will be used to establish the Cu concentrations in successive test exposures.

Definitive tests of 48 hours duration will be conducted using a freshly collected effluent sample. Testing will begin within 96 hours of sample collection. Exposure solutions will be prepared by preparing a large volume of the highest test concentration of site water and laboratory water. Serial dilutions of the spiked site water and laboratory water will be prepared using unspiked portions of the site water and laboratory water, respectively, as diluent. The same Cu stock solution (prepared as above) will be used to spike both site water and laboratory water samples. The mixed solutions will then be allowed to equilibrate at test temperature for 1 to 4 hours.

After the equilibration period, appropriate volumes (25 mL) of exposure solution will be dispensed into the test chambers. Aliquots of these initial test solutions will be retained for Cu analysis as described in following sections. Test organisms will be assigned randomly to the test chambers. Five test chambers, each containing five organisms, will be used for both the site water and laboratory water tests. Four of the chambers will serve as the actual experimental chambers that will provide the counts of surviving organisms. The fifth chamber of each test concentration will be used as a “chemistry control.” Routine test measurements such as temperature, dissolved oxygen, and pH will be taken from the chemistry controls to reduce the possibility of cross contamination of test solutions due to the use of instrument probes during routine test maintenance. Test organisms for both the site water and the laboratory tests will be added at the same time (within 0.5 hour). The two tests (site water and laboratory water) will then be conducted so that there are no differences other than the composition of the dilution water and the Cu concentrations.

Tests will be maintained and test organism effects/symptoms will be observed and recorded as specified in EPA (2002).

If the rangefinding test indicates that test solution renewal at 24 hours is needed, a fresh set of exposure solutions will be prepared and transferred to clean test chambers in the same way as described above. Aliquots of the new solutions will be retained for the analysis of Cu as described in Section 3.0. Test organisms from the old solutions will then be transferred to the new solutions using a pipette. Old solutions from each exposure replicate will be combined into a single aliquot for each test exposure for Cu analysis as described in Section 3.0.

For non-renewal tests aliquots, the test solutions will be retained for the analysis of Cu at the beginning and at the end of the test as described in Section 3.0.

2.4.3 Combined Metal Tests

As previoulsy noted testing and analysis to develop the CuWER is part of a concurent study to develop a WER-based site specific criterion for Zn which must follow EPA (1994). Page 135 of EPA (1994) states that when WERs for more than 1 metal are being developed "...one or more toxicity test must be condcuted at the end to show that the combination of all metals at their proposed new site-specific criteria is acceptable." Accordingly, an additional test will be condcuted using the primary test species in effluent spiked to levels of Cu and Zn equal to the proposed criteria. The proposed criteria will be based on Cu and Zn criteria values (10.99 and 96.81 µgt/L, respectively),which are the the criteria values used the determination of permit limits per page 14 of the Fact Sheet for AR00400967. The test will be an acute, 48 hour test using the proposed criteria as a midpoint in the concentration series with 2 additional concentrations higher and lower than the midpointwith a 0.6 dilution factor separating concentrations.

3.0 CHEMICAL AND OTHER MEASUREMENTS

Effluent samples collected for each series of tests (including range-finding tests and definitive tests) will be analyzed for the parameters listed in Table 3.1. This parameter list includes routine NPDES permit parameters that are analyzed to document plant operating conditions and to perform BLM calculations (Di Toro et al. 2001).

Table 3.1. Analytical parameters for water samples to be collected for WER testing.

Parameter	**Analytical Method**	**Reporting Limit (mg/L)**
Total Recoverable Copper *	EPA 200.8	0.006
Dissolved copper *	EPA 200.8	0.006
Total Recoverable Zinc *	EPA 200.8	0.006
Dissolved Zinc *	EPA 200.8	0.006
Fecal Coliform Bacteria**	SM 9221, 9222	10 CFU/100mL
Total ammonia	SM 4500 NH3-E	0.1
pH **	HydroLab meter	Not applicable
Dissolved Oxygen **	HydroLab meter	0.5
Temperature **	HydroLab meter	Not applicable
Total Organic Carbon *	EPA 415.1	1.0
Dissolved Organic Carbon *	EPA 415.1	1.0
Hardness*	EPA 130.1	1.0
Total Alkalinity*	EPA 310.2	10
TSS *	EPA 160.2	4.0
CBOD5 *	EPA 405.1	2.0
Sodium	EPA 300.0	1.0
Potassium	EPA 300.0	1.0
Chloride	EPA 300.0	1.0
Sulfate	EPA 300.0	1.0

*Parameters also to be measured in laboratory water.
** Measured in effluent at the time of sample arrival to the laboratory.

Samples for the analysis of Cu will be collected from each concentration at the beginning and end of each 24-hour period. The sample for the end of a 24-hour period (and/or the end of the test, as appropriate) for a particular test concentration will be collected by combining all four replicates into a single composite. A portion of the composite will then be filtered through a

0.45-μ membrane filter to be used for the analysis of dissolved metal. The preserved samples will be analyzed as a single batch at the end of the test. Analyses will be conducted only on those concentrations necessary for LC50 calculations.

4.0 DATA QUALITY OBJECTIVES

Toxicity testing and analytical procedures and results will undergo Quality Assurance/Quality Control (QA/QC) review as specified in AIC's written QA/QC procedures. Toxicity test acceptance criteria are summarized in Table 4.1. Acceptance criteria for chemical analyses are provided in Table 4.2. Toxicity tests that do not meet acceptance criteria will not be considered valid for the study purposes. Chemical analyses that do not meet acceptance criteria will be repeated, if possible. The need to invalidate testing based on failure to meet acceptance criteria for chemical analyses will be determined, with agency consultation, based on the type and severity of the failure. Toxicity and analytical tests may also be invalidated for additional reasons identified during the routine QA/QC review performed by AIC.

Table 4.1. Acceptance criteria for toxicity tests.

Test Parameter	Acceptance Criterion
Temperature	25ºC ± 1ºC[a]
Dissolved oxygen	> 6 mg/L in all test concentrations[b]
pH	6.5 – 8.5 su[c]
Performance control survival	≥ 90%[a,c]
Unspiked effluent control	≥ 90%[a,c]
Percent decrease in dissolved metal concentration between initial and final measurements	< 50%[c]
Percent of adversely affected organisms in laboratory water test	> 50% in at least one test concentration[c]
Percent of adversely affected organisms in effluent test	< 50% in at least one test concentration[c]
Dose response	Inverted dose response does not affect more than two concentrations having between 20% and 80% mortality[c]

Notes:
a. Based on EPA (2002).
b. Based on typical levels observed during routine biomonitoring.
c. Based on EPA (1994).

Table 4.2. Acceptance criteria for chemical analyses.

Analytical Parameter	Quality Control Parameter		
	Duplicate RPD	LCS % Recovery	Laboratory Blank (mg/L)
Biochemical Oxygen Demand	± 20%	85 – 115%	< 1.0
Total Copper	± 20%	85 – 115%	<0.006
Dissolved Copper	± 20%	NA	< 0.006
Total Zinc	± 20%	85 – 115%	<0.006
Dissolved Zinc	± 20%	NA	< 0.006
Total Organic Carbon	± 20%	NA	<1.0
Dissolved Organic Carbon	± 20%	NA	<1.0
Total Ammonia	± 20%	85 – 115%	<0.5
Total Calcium	± 20%	85 – 115%	<0.1
Total Magnesium	± 20%	85 – 115%	<0.03
Total Sodium	± 20%	85 – 115%	<1.0
Total Potassium	± 20%	85 – 115%	<1.0
Sulfate	± 20%	90 – 110%	<0.2
Chloride	± 20%	90 – 110%	<0.2
Total Alkalinity	± 20%	N/A	<1.0
Hardness	± 20%	85 – 115%	<1.0
TSS	± 20%	NA	<4.0
Total Dissolved Solids	± 20%	85 – 115%	<4.0

5.0 CALCULATING AND INTERPRETING RESULTS

LC50 values will be calculated using probit analysis or computational interpolation (e.g., trimmed Spearman-Karber) if the data allow. LC50 and WER computations will be carried out to at least four significant digits to avoid rounding errors.

The measurement of both total and dissolved Cu in the tests will allow calculation of both a total and dissolved WER. WER calculation per EPA (2001) will be as follows.

Step 1: Normalize the LC50s from the laboratory water, the site water, and the SMAV to the same hardness using the following formula:

$$EC50_{\text{at Std Hdns}} = EC50_{\text{at Sample Hdns}} \left(\frac{Std\ Hdns}{Sample\ Hdns} \right)^{0.9422}$$

Where “Std Hdns” is any particular standard hardness value to which all values will be normalized and “Sample Hdns” is the hardness of the laboratory water, the site water, or the SMAV.

Step 2: Calculate the sample WER from LC50 values normalized to the same hardness by dividing the hardness-normalized sample LC50 by the greater of either the hardness-normalized laboratory LC50 or the hardness-normalized SMAV.

Step 3: The final site WER is then calculated as the geometric mean of the two sample WERs from separate samples collected at least one month apart.

6.0 REPORTING RESULTS

A report of the results will be prepared containing, at a minimum, the information required by Appendix A, Section H of EPA's Streamlined Procedure (2001). The report will also include appendices with copies of the sample custody reports, the bioassay data sheets, the laboratory analytical reports, statistical analysis inputs/outputs records local precipitation and effluent and receiving stream flows[3].

[3] Local precipitation and receiving stream flows for Lee Creek at Lee Creek Reservoir are monitoring at USGS gaging station 07250085 near Van Buren,AR

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APPENDIX A

ADEQ Summary Letter

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5301 Northshore Drive
North Little Rock, AR 72118-5317

Re: NPDES AR0040967, AFIN: 17-00565
Van Buren, Arkansas, North Plant
Copper and Zinc

Dear Mr. Suel:

Per our telephone conversation on September 18, 2012;

1. **WER Work Plan**

   The Van Buren Municipal Utilities has contracted with FTN Associates Ltd. for the preparation and submittal to the ADEQ of a work plan for the development of Water Effect Ratios for Copper and Zinc. (Copy of agreement attached)

2. **Summary of Van Buren Municipal Utilities efforts to date to locate sources of influent Copper and Zinc into the North Plant.**

   Please see attached letter dated September 19, 2012 from C. Larry Weir, P.E., Van Buren Municipal Utilities Commission Engineer.

Based on past correspondence and conversation, the Van Buren Municipal Utilities requests the following consideration;

1. Before undergoing the expense of developing the Water Effect Ratios for Copper and Zinc we wish to know if ADEQ will consider revising the effluent limits for

Copper and Zinc at the North Plant should the attached summary and Work Plan be approved, and the WERs show cause for reduction of limits.

2. We wish to know if there is a procedure or methodology that would allow the ADEQ to remove the Copper and Zinc Limits based on the North Plant discharging into the backwaters of the Arkansas River as previously discussed.

Thank you in advance for these considerations, please contact me if you should have any questions or need further information.

Respectfully,

Steve Dufresne

Steve Dufresne
Director of Utilities

Cc: file
Darel Manus, Operations Superintendent
Larry Weir, P.E., Commission Engineer

EXHIBIT A

Scope of Work for Basic Services
Proposal to Develop Technical Justification for
Water-Effects Ratios for Copper and Zinc

This exhibit is attached to and made part of this Letter Agreement dated September 21, 2012, between FTN Associates, Ltd. (FTN) and Van Buren Municipal Utilities (Client). The 2 tasks of this scope will be to develop water-effects ratios for Cu and Zn. This cost proposal assumes that the supporting data for the Cu WER can be developed using EPA's "streamlined" WER guidance (EPA, 2001)[1] while the supporting data for the Zn WER will be developed using the "interim guidance (EPA, 1994)[2]. The tasks expected to be included in this project are as follows:

TASK 1 PREPARATION AND SUBMITTAL OF WORK PLANS

TASK 1.1 PREPARATION OF COPPER WORK PLAN

FTN will prepare a Draft Work Plan that describes the type, quantity and quality of technical data required to support the Cu WER as well as the required information for the Justification Report. FTN will submit the Draft Work Plan to the Client for review and revise the draft per the Client's review and comment. The data collection and analysis for the Cu WER will follow requirements in EPA's "streamlined" WER guidance (EPA 2001). FTN will submit the draft to ADEQ for review and revise the plan according to comments as necessary to produce Final Work Plan. ADEQ might seek comment and review from Region 6 EPA.

TASK 1.2 PREPARATION OF ZINC WORK PLAN

FTN will prepare a Draft Work Plan that describes the type, quantity and quality of technical data required to support the Zn WER as well as the required information for the Justification Report. FTN will submit the Draft Work Plan to the Client for review and revise the draft per the Client's review and comment. The data collection and analysis for the Zn WER will follow requirements in EPA's original WER guidance (EPA 1994). FTN will submit the draft to ADEQ for review and revise the plan according to comments as necessary to produce Final Work Plan. ADEQ might seek comment and review from Region 6 EPA.

Task 1 lump sum fee: [redacted]

[1] EPA. 1994. Interim guidance on determination and use of water-effect ratios for metals. United States Environmental Protection Agency, Office of Water, EPA-823-B-94-001, February, 1994.

[2] EPA. 2001. Streamlined water-effect ratio procedure for discharges of copper. United States Environmental Protection Agency, Office of Water, EPA-822-R-01-005, March, 2001.

C. Larry Weir, Professional Engineer

Licensed Civil Engineer - Arkansas, Oklahoma, Georgia and Missouri

September 19, 2012

Mr. Steve Dufresne
Director of Utilities
Van Buren Municipal Utilities
2806 Bryan Road
Van Buren, AR 72956

Re: North Plant AR0040967
Recoverable Copper and Zinc

Dear Mr. Dufresne:

This letter is written in response to our discussions about the efforts of the Van Buren Municipal Utilities to identify the sources of the excessive contributions of copper and zinc to the North Plant collection system deemed to be the cause of the plant's failure to meet specified discharge limits.

As you are aware, the permit referenced by number above set forth limits for total recoverable copper of 9.2 μg (monthly average) and 18.5 μg (7-day average). The limits for zinc were similarly set at 85.5 μg and 171.6 μg.

It was recognized that the subject plant is in a collecting drainage basin that is largely domestic contributors but does include some commercial contributors, those being a commercial truck wash, car washes, as well as retail facilities, auto repair, schools, and so forth.

Our initial thoughts were to confirm the accuracy of our testing results. The laboratory had heretofore been reporting metals contributions in mg/l and there was a need to confirm the detection limits. In January of 2008, a series of influent and effluent tests were recommended and performed at the plant

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c.l.weir@sbcglobal.net

for this purpose enlisting the independent testing of another contract laboratory, American Interplex.

A series of samples and testing was performed to determine the typical background wastewater concentrations of copper and zinc from collection areas that are only residential and those that included typical commercial sources. Samples were also tested from the commercial truck wash as well as from car washes.

From August of 2009 through June of 2010, the Utility collected samples from various lines carefully moving up the collection system with the intentional object of locating or eliminating sources. During that time samples of influent and effluent were collected at the treatment plant to determine if peaks of discharged metals were reflected in the plant. Generally the removal efficiency at the treatment plant was noted to be 50.4% for copper and 42.9% for zinc.

Our efforts to locate a definitive source were not successful. The pretreatment coordinator had previously surveyed the collection system for potential contributors but then, in July of 2010, visited and interviewed those likely commercial contributors along the lines for potential other sources. Those interviewed and inspected included Wal-Mart, Lowes, mechanic and body shops, tire shops, and so on. The investigation also included an overview check of chemicals being used for cleaning and waxes that may be discharged routinely to the sewer. Although all were cooperative with an explanation of the difficulties, nothing definitive was determined or located.

We have interviewed the City of Fort Smith, Van Buren's water supplier, and determined that the Fort Smith water supply has a normal copper and zinc concentration of 0.31 μg and 4.9 μg respectively. The drinking water has a maintained pH range of 8.5-9 with an observed average of around 8.3.

The North Plant does not receive hauled wastes for treatment nor is the discharge of haulers allowed within the system. The Utility is not aware of instances of illegal or otherwise approved discharges that would explain the contributions of copper and zinc to the system.

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A point has been made that the discharge of the North Plant to Lee Creek is at an elevation that is below the normal pool elevation of the Arkansas River and consideration was requested for leniency in the discharge limits based on this discharge point being backwater. We are unable to contend that Lee Creek is not intermittent at some times of the year although the Arkansas River does maintain a pool at the location of the discharge.

The Utilities bio-monitoring has not shown there to be a problem with the plant's effluent from that standpoint. In lieu of additional expense, the Utility wishes to verify that the limits are necessary to the extent that they have been set. It is understood that additional specific testing can be performed to establish the limits that would be toxic. The Utility has investigated the determination of the Water Effects Ratio (WER) for both copper and zinc discharges and has discussed this procedure in some depth with FTN Associates. To date FTN has determined from sampling and evaluation that Biotic Ligand Model indicates positive results for justification of higher limits for copper based on the WER. It is possible that a similar circumstance may hold true for Zinc although a model is not readily available for Zinc.

While there is some expense involved with the WER evaluation, it is believed the potential to be far more cost effective to the alternatives of treatment or relocating the discharge from this plant. Another alternative is the continuation of sampling of the collection system in a systematic source of the copper and zinc contributions which may have background domestic points of origin that are not controllable.

Respectfully,

C. Larry Weir, P.E.

1714 Bunker Hill Drive
Van Buren, Arkansas 72956-2826

telephone - 479.883.1317
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STEVE DUFRESNE
VAN BUREN MUNICIPAL UTILITIES
P. O. DRAWER 1269
VAN BUREN, AR 72957

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Mr. Kevin Suel
Enforcement Analyst
Water Division Enforcement Branch
Arkansas Department of Environmental Quality
5301 Northshore Drive
North Little Rock, AR 72118-5317

APPENDIX B

ADEQ Pretreatment Program Audit and Municipal Pollution Prevention Assessment

ADEQ

ARKANSAS
Department of Environmental Quality

July 10, 2012

Gary Smith, Director of Utilities
City of Van Buren
P O Box 1269
Van Buren, AR 72956

Re: City of Van Buren (AFIN: 17-00062 NPDES Permit Number: AR0021482)
Pretreatment Program Audit & Municipal Pollution Prevention (P2) Assessment

Dear Mr. Smith:

Please find enclosed the finished report for the audit/assessment conducted by the Department from June 19th through 21st, 2012. The report should be made available for review by appropriate industrial and City officials. The Van Buren staff should discuss and evaluate the findings in this report. Please respond to the required actions and recommendations in writing within thirty (30) days.

The Department appreciates the staff's assistance. The staff appeared very interested in both the Pretreatment and Pollution Prevention Programs. Most of the recommendations in the attached audit/assessment are intended to aide the City's pretreatment program with achieving the objectives of the Clean Water Act.

If the City has questions or concerns, please do not hesitate to contact the Department at (501) 682-0626 or torrence@adeq.state.ar.us .

Sincerely,

Rufus J. Torrence

Rufus J. Torrence, Water Division Engineer

Encl: Audit Report/Assessment Checklist

Cc: Rudy Molinda / EPA 6WQ-PM (via e-mail w/o attmt)
Eric Fleming / Mgr-Field Services (w/o attmt)

PRETREATMENT PROGRAM AUDIT/

POLLUTION PREVENTION ASSESSMENT

CITY OF VAN BUREN, ARKANSAS

NPDES PERMIT #AR0021482

July 10, 2012

PREPARED BY: Rufus Torrence

ADEQ Water Division Engineer and Auditor

ARKANSAS DEPARTMENT OF ENVIRONMENTAL QUALITY

5301 Northshore Drive

NORTH LITTLE ROCK, ARKANSAS 72118-5317

Van Buren's Pretreatment Program was originally approved 10/1/81. Subsequent modifications were submitted, approved and incorporated into the City's NPDES permit on 3/21/90, on 3/6/97 and recently on 3/18/2011. These modifications included changes in the City's Pretreatment Ordinance, headworks loading evaluation and minor program narrative revisions. The City recently updated the pretreatment program to comply with the recent revisions to 40 CFR Part 403. These revisions are commonly referred to as the "Streamlining" updates.

The City has three (3) wastewater treatment plants. The main (South) POTW design flow was increased to 4.0 MGD. The South Plant has a screening unit, two 60' diameter secondary clarifiers, UV disinfection unit, flow monitoring equipment, and standby power source. The old aerated lagoon was modified to an activated sludge unit consisting of two aerated basins (combined surface area of 56,292 square feet), aerobic sludge storage (surface area of 46,354 square feet), and an equalization basin (surface area 167,777 square feet). Eight (8) significant (four are categorical) industrial users (SIUs) contribute about 0.70 millions gallons each day to the POTW. The South POTW discharges into the Arkansas River. The POTW effluent has exhibited no toxicity to aquatic life. Constructing and upgrading the plant, the City dredged the lagoon and land applied the sludge in July 2008 on nearby City-owned property. The sludge had low metal content (Copper at 13 mg/kg and Zinc at 54 mg/kg).

The Lee Creek POTW is a simple activated sludge package treatment plant operating under extended aeration conditions. This POTW design flow is 0.04 MGD. The POTW has no significant industrial user contributions and accepts only sanitary wastewater from Bekaert Steel, a nearby ball park and an I-40 rest area. The POTW treated effluent is chlorine disinfected and discharged to the Arkansas River. Accumulated sludge is wasted to an aerated holding digester and periodically transported to the North POTW.

The North POTW is a closed loop reactor, has a 2 channel orbal design, and has an oxidation ditch with 2 stage clarification. A non-categorical SIU contributes about 10,000 gallons each day to the POTW. The POTW design flow is 2.0 MGD and discharges to Lee Creek. The POTW effluent is disinfected in a UV contact chamber and discharged to the creek. The POTW effluent has exhibited no toxicity to aquatic life. Biosolids are periodically dredged and land applied on City property.

Effective on 3-1-11, the North Plant has permit limits for Copper (9.2 μg/l) and Zinc (85.5 μg/l). Monitoring results submitted to ADEQ indicate a pattern of violations for both metals. Since the North plant has only one significant industrial user (Arkansas Valley Truck Wash), the source of the metals appear to be from domestic users. The City should be aware that the pretreatment program will probably not be placed in SNC (significant noncompliance) for pass through ("pass through" is limited to non-domestic sources) if the North plant continues to violate the effluent metal limits. However, ADEQ enforcement has expressed concerns for violating the NPDES permit limits (See Attachment I-1/3 for more details).

The audit/assessment consisted of informal discussions with the City's Pretreatment Coordinator, examination of industrial user files, pretreatment records and site visits to five (5) industrial users. The auditor utilized a checklist to ensure that all facets of the program were evaluated. A copy of the completed checklist is attached. Additional information obtained during the audit is included as Attachments

The report is divided into three sections. Section B provides a summary of the significant findings of the audit which will require action by the City. Section C includes recommendations to help improve the implementation and enforcement of their Pretreatment and Pollution Prevention Programs. Finally, required program modifications to the City's approved program, including its adopted legal authorities, are outlined in Section D.

B) SUMMARY OF FINDINGS WITH REQUIRED ACTIONS

This section of the report is a summary of deficiencies found in the City of Van Buren's Pretreatment Program. The auditor has paraphrased with CFR citations the actions required by the City to comply with the current General Pretreatment Regulations (40 CFR 403) and with the approved program. A narrative explanation of the finding will follow the citations.

1) Under ***40 CFR Part 408.5(f)(4)*** find "*The POTW shall develop local limits as required in §403.5(c)(1), or demonstrate that they are not necessary.*

The City's North plant has permit limits for Copper (9.2 ug/l) and Zinc (85.5 ug/l) which became effective on March 1, 2011. The permit limits are included to prevent pass through to the receiving stream (Lee Creek). The Copper and Zinc in the North plant effluent are consistently higher than WQS for the receiving stream and, hence, the plant is consistently in violation of the NPDES permit limits for Copper and Zinc. The North plant is not designed to remove Copper or Zinc.

The North plant has only one significant industrial user. The metals in the influent appear to originate from domestic sources (see Attachment L-6/14) as the metal levels in the influent are typical for domestic wastewater. Local limits apply to non-domestic sources only. ADEQ has provided the City with guidance (see Attachment K-1/6) which indicates that local limits for toxic and conventional pollutants are not necessary for the City's two main POTWs. Nonetheless, the City has a <u>Duty to Comply</u> with the NPDES permit limits and must take steps to remedy the violations. In a letter dated March 13, 2012, the Department required the City to work toward compliance (see Attachment I-1/3). Finally, the City must either develop local limits for all pollutants of concern or confirm that local limits are not necessary (see Recommendation #1 & #4 below for more details).

C) RECOMMENDED POTW ACTIONS FOR IMPROVED IMPLEMENTATION OF THE PRETREATMENT AND POLLUTION PREVENTION PROGRAMS

1) The Department will not require the City to develop local limits at this time. Based on the influent loading data shown in Attachment K-3/6, the conventional pollutant loadings to the South average only about half of the design capacity. Since the metals enter the South and North plant at domestic levels, local limits for metals at both plants appear unnecessary. However, the Department recommends that the City develop local limits for at least $CBOD_5$ and TSS for the South Plant. Referring to Attachments L-6/14 and L-9/14, the City has demonstrated that local limits are not necessary for Arsenic, Cadmium, Chromium, Copper, Cyanide, Lead, Mercury, Nickel, Selenium, Silver and Zinc as these pollutants enter the POTW below EPA Typical Domestic Levels. The City has no point source for Ammonia.

2) River City Coating permit has a fact sheet which shows the derivation of mass limits. The previous permit had mass limits. Since the present permit does not have mass limits, the City should remove the derivation from the fact sheet. See Attachment F-3/3 for details.

3) The City should consider developing a Water Effect Ratio (WER) for Copper and Zinc for the North Plant. The North Plant is consistently violating the permit limits for Copper and Zinc. A WER greater than 1 will increase the permit limits for Copper and Zinc. The Department has provided the City with guidance and contact information.

4) The South Plant occasionally violates the NPDES permit limits for ammonia. Since the City does not have a point source for ammonia, a local limit for ammonia will not remedy the violations. However, the City can request assistance from point sources of CBOD.

The City influent flow varies considerably over the course of a week. The variation in flow appears to follow the pattern of discharger from the three main hydraulic dischargers (Simmons Poultry, Simmons Food and Tyson Food). The City should consider coordinating the discharges from these three SIUs to level the influent flow and CBOD loading. A steady organic loading may assist the plant with nitrification and dinitrification.

5) Since the Metal Finishers are not significant sources of organic loading, the City should consider removing the BOD and TSS limits from these permits.

APPENDIX C

Biotic Ligand Model Input and Output

Table C.1. BLM input.

Sampling Date	Ion/parameter												
	Temp	pH	Dissolved Cu	DOC	%HA	Ca	Mg	Na	K	SO_4	Cl	Total Alkalinity	S=
07/01/2012	25	8	14	5.7	10	27	4	40	16	20	39	28	0.001

Table C.2. BLM output.

Output Parameter	Output Value	Output Parameter	Output Value
pH (Std. Units)	8.5	Total Ca	1.12E-03
Dissolved Cu	7.02E-06	Total Mg	5.76E-04
Free Cu	1.08E-09	Total Na	7.40E-03
Total Organic Cu	6.77E-06	Total K	2.56E-04
BL-Cu	4.25E-02	Total SO_4	1.56E-03
BL-CuOH	2.76E-02	Total Cl	3.95E-03
DOC	8.60E+00	Total CO_3	3.57E-03
HA%	1.00E+01	Total S	3.12E-08

All values in mol/L unless otherwise noted.

Table C.3. Summary BLM results.

Sample	Hardness	BLM Predicted LC50		Adjusted LC50 (hardness =50)	Predicted WER (Total Cu)
		mol/L	ug/L		
7/1/2012	71.5	2.38E-06	151.13	207.31156	8.6

APPENDIX D

Study Plan for Zinc WER Development

FTN Associates Ltd.
water resources / environmental consultants

WORK PLAN TO DEVELOP A SITE-SPECIFIC CRITERION FOR ZINC BASED ON A WATER-EFFECTS RATIO

VAN BUREN, OUTFALL 001 NPDES PERMIT NO. AR0040967

FINAL
SEPTEMBER 15, 2014

WORK PLAN TO DEVELOP
A SITE-SPECIFIC CRITERION FOR ZINC BASED ON
A WATER-EFFECTS RATIO

VAN BUREN, OUTFALL 001
NPDES PERMIT NO. AR0040967

Prepared for

Arkansas Department of Environmental Quality
5301 Northshore Drive
North Little Rock, AR 72118-5317

Submitted by

Van Buren Municipal Utilities
2806 Bryan Rd.
Van Buren, AR 72956

Prepared by

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

FTN No. 04335-0001-001

FINAL
September 15, 2014

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1.0 INTRODUCTION

The purpose of this document is to present a work plan for conducting a water-effects ratio (WER) study for Outfall 001 of the Van Buren North Treatment Plant located in Van Buren, Arkansas (National Pollutant Discharge Elimination System [NPDES] Permit No. AR0040967) and operated by Van Buren Municipal Utilities (VBMU). The WER study is being proposed as provided in Arkansas Pollution Control and Ecology Commission (APCEC) Regulation No. 2, *Regulation Establishing Water Quality Standards for Surface Waters of the State of Arkansas* (2011). Section 2.308 of Regulation No. 2 allows alternative chemical-specific water quality criteria (WQC) that reflect site-specific conditions. This plan has been Final per written comments received from the Arkansas Department of Environmental Quality (ADEQ) on 2/26/2014 and the Environmental Protection Agency (EPA) on 6/13/2014. This document incorporates all changes requested by both ADEQ and EPA.

The objective of this study is to develop a WER to support a site-specific water quality criterion for zinc (Zn) in Reach 002 of Lee Creek. It is part of a concurrent study (addressed in a separate document) to develop a WER-based site specific criterion for copper (Cu). The technical approach to develop the Cu WER (discussed in a separate work plan document) will follow the Streamlined Procedure (EPA 2001). The technical approach for the Zn WER will follow the Interim Procedure (EPA 1994) because the Streamlined Procedure does not apply to Zn.

1.1 Options Considered

Options that VBMU considered towards achieving compliance with its NPDES permit limit for Zn were a site-specific criterion, treatment, source control and permit modification to classify Outfall 001 as a discharge to the Arkansas River.

VBMU conducted an evaluation of the sanitary waste collection system in an attempt the identify Zn sources that could be targeted to control influent Zn concentrations. This evaluation (Appendix A) could not identify specific discreet sources of Zn on which to focus source control and concluded that Zn loading to the plant is from domestic sources.

There is a wide range of known or potential treatment technologies that could, in principle, be implemented as part of the VBMU treatment. In general, however, only precipitation/flocculation technologies are feasible at an industrial scale as would be required for the VBMU North Plant (Blais et al, 2008). While this technology is adequate to reduce wastewater metal concentrations to ~0.5 mg/L levels, it is not adequate to consistently achieve the additional order of magnitude removal required to attain Zn concentrations < 50 µg/L (Lankford, 1990).

VBMU also considered the possibility of reclassifying Outfall 001as a discharge to the Arkansas River. Arkansas Department of Environmental Quality (ADEQ) rejected VBMU's technical rational for a permit modification based on such a reclassification.

In its Pretreatment Program Audit and Municipal Pollution Prevention Assessment, (Appendix B) ADEQ staff recommended that “The City should consider developing a WER for Copper and Zn for the North Plant. The North Plant is consistently violating the permit limits for Copper and Zn. A WER greater than 1 will increase the permit limits for Copper and Zn. The Department has provided the City with guidance and contact information.” Accordingly, VBMU is proposing the study described herein to provide justification for a site-specific criterion for Zn in the portion of Reach 002 of Lee Creek from the edge of the mixing zone with the Arkansas River to VBMU's permitted outfall in Crawford County. This approach would involve modification of Arkansas' Regulation No. 2 through a third party rulemaking.

1.2 Receiving Stream

Outfall 001 discharges into the Arkansas River via Lee Creek in Segment 3H of the Arkansas River Basin. The receiving stream with US Geological Survey (USGS) 8-digit hydrologic unit code (HUC) 11110104 and Reach No. 002 is a water of the state classified for primary contact recreation; raw water source for public, industrial, and agricultural water supplies; propagation of desirable species of fish and other aquatic life; and other compatible uses. The reaches of Lee Creek and the Arkansas River that receive the discharge are not listed on the Final 2012 Arkansas 303(d) list of water quality-limited waterbodies.

1.3 Facility Process Description

The facility has a design flow of 2.0 million gallons per day (MGD) and treats municipal waste. Treatment includes bar screens, three individual oxidation ditches with the final clarifiers operated in parallel, followed by UV disinfection. At any time all or any combination of the three systems can be operated.

An equalization pond is used during wet weather conditions to reducing flow during or following storm events. The amount diverted to the surge pond depends on the amount to keep the effluent flow below 2.0 MGD, or an amount that can be treated. The equalization pond may also be used to reduce flows through the plant to prevent solids wash-out from clogged return telescope valves and for maintenance purposes. All water diverted through the equalization pond is eventually pumped through the treatment system. All diversions are controlled by manual valves

1.4 Discharge Characteristics

Permit limits for the existing NPDES permit are provided in Table 1.1. Discharge characteristics (including biomonitoring), as indicated by routine discharge monitoring reports (DMRs), are summarized in Tables 1.2, 1.3 and 1.4. Under the present permit (effective March 1, 2008) there have been four whole effluent toxicity (WET) test excursions in routine biomonitoring (Table 1.2).[1] Persistent toxicity was never identified in the required retesting. In addition, Figure 1.1 shows a time series plot of Zn concentrations with an indication of the timing of WET excursions. VBMU generally collects samples for Zn analyses as part of the second composite sample collected for chronic biomonitoring tests. Therefore the data points for Zn concentrations and WET analyses in Figure 1.1 represent concurrent measurements. The plot shows that WET excursions did not occur during periods of relatively high Zn concentrations.

[1] This table was current at the time of the original submission of this plan for agency review (March 4, 2013). An updated analysis WET test results and other DMR monitoring will be provided as part of the documentation supporting the site-specific criterion.

A summary of exceedance factors (measured Zn concentration ÷ permit limit) for recent (January 2010 through December 2012) routine monitoring data is presented in Table 1.4. The 95th percentile values for the exceedance factors corresponding to the monthly average and weekly average permit limits are 3.3 and 1.6, respectively. This result indicates that the existing monthly average permit limit would need to be increased by a factor of approximately 3.3 to result in permit compliance. This monitoring indicates that:

1. Cu and Zn exceed effluent limitations;
2. The discharge is in general compliance with its permit on other parameters;
3. The discharge has not shown toxicity at the critical dilution (100%) since October 2010, (see footnote 1); and
4. Previous episodes of toxicity do not correspond to periods of elevated Zn concentrations.

Table 1.1. Current NPDES permit discharge limits for Outfall 001.

Effluent Characteristics	Discharge Limitations (mg/L, unless otherwise specified) Monthly Average	7-day Average
Flow	N/A	Report
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)		
May – October	10.0	15.0
November – April	20.0	30.0
Total Suspended Solids (TSS)		
May – October	15.0	22.5
November – April	20.0	30.0
Ammonia Nitrogen		
April	2.2	5.6
May – October	2.0	3.0
November – March	4.0	6.0
Dissolved Oxygen		
May – October	5.0 (Monthly Average Minimum)	
November – April	6.0 (Monthly Average Minimum)	
Fecal Coliform Bacteria (FCB)		
April – September	200 colony-forming units (CFU)/100mL	400 CFU/100mL
October – March	1000 CFU/100mL	2,000 CFU/100mL
Copper, Total Recoverable	9.2 µg/L	18.5 µg/L
Zn, Total Recoverable	85.5 µg/L	171.6 µg/L
pH	Minimum: 6.0 su	Maximum: 9.0 su
***Pimephales promelas* (Chronic)**	**7-day Average**	
Pass/Fail Lethality (7-day NOEC*)	Report (Pass/Fail)	
Pass/Fail Growth (7-day NOEC)	Report (Pass/Fail)	
Survival (7-day NOEC)	Report %	
Coefficient of Variation	Report %	
Reproduction (7-day NOEC)	Report %	
***Ceriodaphnia dubia* (Chronic)**	**7-day Average**	
Pass/Fail Lethality (7-day NOEC)	Report (Pass/Fail)	
Pass/Fail Growth (7-day NOEC)	Report (Pass/Fail)	
Survival (7-day NOEC)	Report %	
Coefficient of Variation	Report %	
Reproduction (7-day NOEC)	Report %	

*NOEC- No observed effect concentration.

Table 1.2. Summary of no observed effect concentration (NOEC) (% effluent) volume from the most recent 3 years of routine biomonitoring at the Van Buren North Treatment Plant Outfall 001.

Sampling Dates	*P. promelas*		*C. dubia*	
	Survival	**Growth**	**Survival**	**Reproduction**
11/11/12 - 11/15/12	100	100	100	100
07/22/12 – 07/26/12	100	100	100	100
04/15/12 – 04/19/12	100	100	100	100
01/15/12-01/19/12	100	100	100	100
11/13/11-11/17/11	100	100	100	100
07/10/11-07/14/11	100	100	100	100
04/03/11-04/07/11	100	100	100	100
03/06/11-03/10/11	No Test	No Test	100	100
01/23/11-01/27/11	100	100	Control Failure	Control Failure
12/05/10-12/09/10	No Test	No Test	100	100
11/14/10-11/18/10	100	100	100	100
10/24/10-10/28/10	100	100	100	< 100
07/18/10-07/22/10	100	100	100	100
04/11/10-04/15/10	100	100	100	100
01/10/10-01/14/10	100	100	100	100
11/29/09-12/03/09	100	100	< 100	< 100
11/08/09-11/12/09	100	100	100	100
10/25/09-10/29/09	100	100	100	100
09/13/09-09/17/09	< 100	< 100	100	< 100
08/30/09-09/03/09	No Test	No Test	100	100
07/26/09-07/30/09	No Test	No Test	100	100
06/23/09-06/28/09	No Test	No Test	100	100
06/07/09-06/11/09	100	100	100	< 100
02/22/09-02/26/09	100	100	100	100

Table 1.3. Summary of DMR monitoring at Outfall 001,October 2009 through September 2012.

Summary Statistic		Avg Flow (mgd)	Max Flow (mgd)	CBOD (mg/L)	TSS (mg/L)	FCB (CFU)	pH (min)	pH (max)	DO (mg/L)	NH_3-N (mg/L)	Cu (µg/L)	Zn (µg/L)
Percentile	25	0.79	1.12	3.5	1.8	4.8	6.1	6.6	7.6	0.11	6.3	48.4
	50	1.02	2.01	4.0	2.4	11	6.2	6.7	8.2	0.17	8.0	69.0
	75	1.36	2.70	4.5	3.0	26	6.2	6.8	9.2	0.24	9.1	84.8
	95	1.91	3.89	7.3	5.2	67	6.3	7.0	9.9	0.60	14	164
Minimum		0.56	0.66	3.0	1.0	1.0	6.1	6.2	6.9	0.05	4.7	40.0
Average		1.12	2.06	4.3	2.6	20	6.2	6.7	8.4	0.23	8.5	79.6
Maximum		2.15	4.94	7.5	5.8	102	6.4	7.1	10.2	0.98	18	249

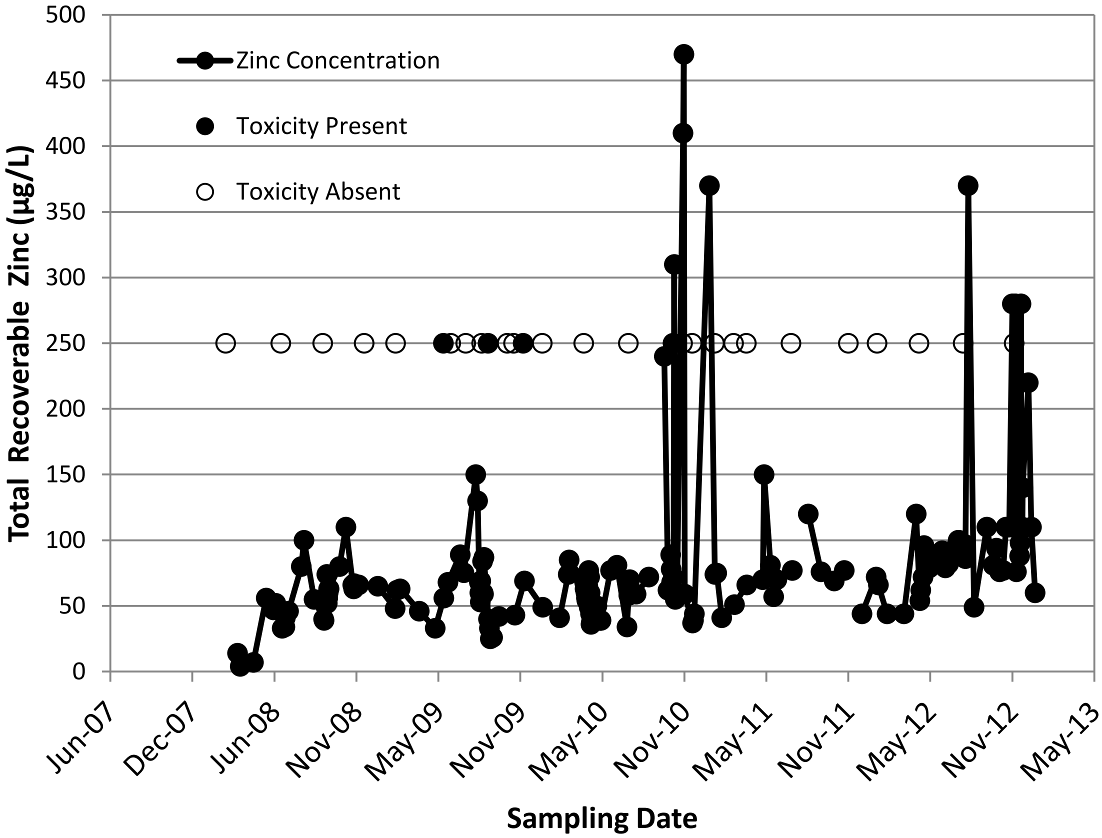

Figure 1.1. Plot of Zn concentrations and occurrences of WET excursions.

Table 1.4. Summary of Zn and copper concentrations and exceedance factors based on Outfall 001 monitoring from January 2010 through December 2012.

Summary Statistic		Copper			Zn		
		Concentration (µg/L)	Exceedance Factor		Concentration (µg/L)	Exceedance Factor	
			Monthly Average	Weekly Average		Monthly Average	Weekly Average
Pctl*	95	19	2.1	1.0	280	3.3	1.6
	75	12	1.3	0.6	94.5	1.1	0.6
	50	9.9	1.1	0.5	75.0	0.9	0.4
	25	7.5	0.8	0.4	57.8	0.7	0.3
Minimum		3.7	0.4	0.2	34.0	0.4	0.2
Average		11.1	1.2	0.6	95.7	1.1	0.6
Maximum		58.0	6.3	3.1	470	5.5	2.7
Proportion Exceeding Permit Limit			0.56	0.06		0.34	0.09

* Percentile

1.5 Proposed Approach

Technical guidance for conducting a WER study is provided in US Environmental Protection Agency's (EPA) Interim Procedure (EPA 1994), which applies to most metals. Accordingly, WER testing for Van Buren will be conducted according to EPA (1994).

The proposed approach will use "Method 1" in EPA (1994) to develop both Type 1 and Type 2 WERs. Method 1 can be used to determine a WER in the vicinity of a plume or in receiving streams with zero flow (EPA 1994). Written comments provided by EPA on 6/16/2014 requested that two Type 1 WERs and one Type 2 WER be conducted on samples collected at least 3 weeks apart as follows:

- Two WERs determined using 100% effluent (Type 1 WERs); and
- One WER determined when elevated flows are present in Lee Creek due to a rainfall event (Type 2 WER), with the effluent and upstream water mixed at the ratio of the flows that exist when the samples are taken.

1.5.1 Type I WERs

The critical flow for Outfall 001 is 100%. For each Type 1 WER determination the following metal-spiked sample matrices will be tested concurrently:

1. Laboratory water prepared per EPA (2002), and
2. 100% effluent.

The hardness of the laboratory water test will be approximately 100 mg/L, subject to the restrictions given in Section F.3 of EPA (1994). At total of two Type1 WER tests will be conducted.

To compare the laboratory water and site water LC50s for purposes of WER calculations, the site water LC50s will be normalized to the hardness of the laboratory water using the following formula[2]:

Formula 1.1.

$$LC50_{\ at\ Lab\ Hdns} = LC50_{\ at\ Sample\ Hdns} \left[\frac{Lab\ Hdns}{Sample\ Hdns} \right]^{S}$$

Where: **LC50$_{\text{at Lab Hdns}}$** = LC50 of site water (effluent or simulated downstream sample) normalized to lab water hardness,

LC50$_{\text{at Sample Hdns}}$ = LC50 of effluent test or simulated downstream sample test,

Lab Hdns = hardness of water used in laboratory water test,

Sample Hdns = hardness of effluent or simulated downstream sample, and

S = the log-log slope of the hardness regression for Zn = 0.8473 per Appendix B of EPA's National Recommended Water Quality Criteria[3] and EPA (1984).

This approach is consistent with the use of hardness adjustments given in the Interim Procedure (EPA 1994; Method 1, Section A.6).

1.5.2 Type 2 WERs

Reach No. 002 of Lee Creek is a tailwater below Lee Creek Dam. Water from Lee Creek Reservoir is normally released from Lee Creek Dam over a concrete spillway. Therefore elevated flows in the receiving stream will not correspond to rainfall events due to the lag time between entry of the storm flow into Lee Creek Reservoir and the overtopping of the spillway. In any case, water that overtops the spillway to flow into the receiving stream will be the same water that was in the reservoir at the time of the event. Therefore, the upstream water to be used for the Type 2 test will be collected from the surface of Lee Creek Reservoir near the spillway without

[2] This formula is algebraically equivalent to *LC50at lab hardness = LC50 at sample hardness{*$e^{s[\ln(\text{sample hardness})-\ln(\text{lab hardness})]}$*}* given in EPA 1997.

[3] http://water.epa.gov/scitech/swguidance/standards/current/index.cfm#appendxb

regard to rainfall events. The effluent + receiving stream mix to be used in testing will be based on the median flows recorded at US Geological Survey (USGS) gaging station at Lee Creek Dam (USGS 07250085) using the period of record (POR) from October 1 1993 up to the day of sampling (approximately 95 cfs). The effluent flow used to prepare the effluent + receiving stream mix will be the average flow during the day of sampling and the preceding 2 days. Based on the typical effluent flows the effluent + receiving stream mix to be used in the Type 2 test will be approximately 1 to 2% effluent.

For the Type 2 WER determination, the following metal-spiked sample matrices will be tested concurrently:

1. Laboratory water prepared per EPA (2002), and
2. Effluent + receiving streams.

LC50 values from the tests on laboratory water and site water will be normalized to a common hardness as in Formula 1.1.

1.5.3 Combined Metal Tests

Testing and analysis to develop the WER is part of a concurent study to develop a WER-based site specific criterion for Zn which must follow EPA (1994). Page 135 of EPA (1994) states that when WERs for more than 1 metal are being developed "...one or more toxicity test must be condcuted at the end to show that the combination of all metals at their proposed new site-specific criteria is acceptable." Accordingly, the proposed study will include a toxicity test using the primary test species in effluent spiked to levels of Cu and Zn equal to the proposed criteria.

2.0 SAMPLING AND TESTING PROTOCOL

The following sampling and testing protocol is based on Method 1, Section D through H of EPA (1994). All toxicity test procedures and analytical testing will be conducted by American Interplex Corporation (AIC), which is certified by ADEQ. Per EPA (1994), definitive tests used for WER determination will be conducted on three occasions using samples collected at least 3 weeks apart.

An initial range-finding test will be conducted to identify the concentration range to be used and to evaluate the need for daily renewals in subsequent tests. The first of the three definitive tests will be conducted using both *Ceriodaphnia dubia* and *Pimephales promelas.* Subsequent definitive tests will use the more sensitive species as indicated by the first definitive test[4].

2.1 Test Organisms

The test organisms used for this testing will be *C. dubia* and *P. promelas.* These test organisms are used for VBMU's routine biomonitoring, and their use for WER determination is consistent with recommendations in Appendix I of EPA (1994). Toxicity tests will be conducted using *C. dubia* cultured in "moderately hard" laboratory water (EPA 2002). Recent routine biomonitoring tests indicate an average effluent hardness values of 68 mg/L as $CaCO_3$. In the judgement of the laboratory support personnel and FTN project management, this hardness level is sufficiently similar to the average culture hardness of 84 mg/L to obviate the need for special culture conditions. Therefore, special organism acclimation to site water hardness is not anticipated as part of this project. *C. dubia* used in testing will be < 24 hours of age at the beginning of the test. Test organisms will be fed algae before they are transferred to the test chambers to begin the test. However, no food will be placed in the test containers, and special care will be taken to prevent the transfer of food to the test containers along with the test organisms when the test is loaded. *P. promelas* used in testing will be 1 to 24 hours of age at the

[4] Data presented in Table 1 of EPA (1980) indicate that *C. dubia* and *P. promelas* fry 1 – 24 hours of age might show similar sensitivity to Zn. Therefore it is possible that definitive WER testing might be performed using *P. promelas*.

beginning of the test. Test organisms will be hatched in laboratory dilution water and will not be fed before or during the test. At least 90% of the *P. promelas* fry used in the test must survive in laboratory water for at least 6 days after hatching.

2.2 Sample Collection

The effluent sample will be collected at times when plant operating conditions are average or better, and when the discharge is relatively unaffected by short-term perturbations due to rainfall. Normal operating conditions will be documented based on measurements of DMR monitoring parameters listed in Table 1.3 and flows taken during the time of effluent sampling, and then compared with values typical for the plant. Sample delivery to the testing laboratory will include appropriate completed chain-of-custody.

A 24-hour composite sample of effluent will be collected using an automated sampler from the NPDES compliance point. Sampler bottles will be washed according to AIC QA Plan specifications (detergent-washed, rinsed in acid+deionized water). Samples to be used for toxicity testing will be maintained unpreserved at 1°C to 4°C during collection, shipment, and storage. The flow-weighted composite sample will be prepared in the laboratory using flow data provided by Van Buren personnel. Sub-samples of the composite will be collected for analysis of chemical parameters using appropriate sample-container cleaning and sample preservation. Samples will be stored in the dark at 1°C to 4°C with no headspace in the container.

Receiving stream flows are not relevant to sample collection for the Type 1 WERs because the critical flow for Outfall 001 is 100% and effluent samples to be used in WER testing will not be mixed with water collected from the receiving stream. The receiving stream sample to be used for the Type 2 WER will be collected as a grab sample taken from the surface of Lee Creek Reservoir near the spillway. The receiving stream flows and weather conditions will be documented based on data for two weeks preceding the sampling event from USGS stream monitoring station USGS 07250085 (Lee Creek at Lee Creek Reservoir approximately 1.2 miles upstream of Outfall 001).

2.3 Laboratory Test Water

Water used in the laboratory water toxicity tests will be prepared per EPA (1991). The concentration of total organic carbon (TOC) and total suspended solids (TSS) in the laboratory water will be < 0.5 mg/L and < 4 mg/L, respectively. The concentration of salts used to prepare the laboratory water will be adjusted to provide a hardness of 100 mg/L. This approach will result in laboratory water with hardness between 40 mg/L and 220 mg/L of levels of alkalinity and pH that are appropriate for the hardness, and similar to the site water per EPA requirements (EPA 1994).

2.4 Toxicity Tests

2.4.1 Range-Finding Tests

Range-finding tests of 48 hour duration using *C. dubia* and *Pimephales promelas* will be conducted prior to the definitive toxicity tests used to calculate the WER. The purpose of the range-finding test is to

1. Identify the more sensitive species, which will serve as the primary test species;
2. Determine the appropriate range of Zn concentrations for the definitive tests; and
3. to indicate whether or not the definitive tests can be conducted as static renewal or static non-renewal tests.

The range-finding tests can also provide a preliminary estimate of the WER. Range-finding tests will be conducted on effluent and laboratory water spiked with inorganic Zn salts.

The Zn stock solution used to spike the effluent/receiving stream mixture and laboratory water will be prepared from deionized water and reagent-grade Zn chloride ($ZnCl_2$). The stock solution will be sufficiently concentrated to prevent significant dilution of the effluent or laboratory water with the deionized water matrix. The stock solution will be sufficiently acidified with reagent-grade acid to prevent Zn precipitation during storage, while not containing excess acid that will affect the pH of the test solutions.

Testing will consist of 48 hour static non-renewal tests using ten organisms per concentration and up to eight Zn exposure concentrations. Because the purpose of the range-finding test is to determine the appropriate upper and lower ranges of Zn concentrations for the definitive tests, a dilution factor of 0.32 will be used and Zn concentrations will not be measured at each exposure concentration. However, initial and final Zn concentrations will be measured at selected concentrations to evaluate the change in Zn concentration occurring in the test beakers during the test.

2.4.2 Definitive Tests

Definitive toxicity tests of 48 hour duration to be used for the calculation of the WER will be designed based on the results of the range-finding tests. Two Type 1 tests and one Type 2 test will be conducted using the primary species (more sensitive species based on the rangefinding test) and one Type 1 test will be conducted using the secondary species (less sensitive species based on the range-finding test) Tests will be conducted as static renewal tests if the range-finding tests indicate there will be greater than a 50% decrease in dissolved Zn concentration between the initial and final values or an unacceptable decrease in dissolved oxygen (DO) in the test beakers.

A dilution factor of at least 0.65 will be used to establish the Zn concentrations in successive test exposures. For purposes of preparing this protocol, it is assumed that static renewal tests will be required. The procedure for the static non-renewal test will be essentially identical except for the intervening renewal step. Definitive tests will be conducted using a freshly collected effluent sample. Testing will begin within 36 hours of sample collection. Exposure solutions will be prepared by preparing a large volume of the highest test concentration of effluent and laboratory water. Serial dilutions of the spiked effluent and laboratory water will be prepared using un-spiked portions of the effluent and laboratory water, respectively, as diluent. The same Zn stock solution (prepared as stated above) will be used to spike both effluent and laboratory water samples. The mixed solutions will then be allowed to equilibrate at test temperature for 1 to 3 hours.

After the equilibration period, appropriate volumes of exposure solution (per EPA 2002) will be dispensed into the test chambers. Aliquots of these initial test solutions will be retained for Zn analysis as described in following sections. Test organisms will be assigned randomly or impartially to the test chambers. Five test chambers, each containing five organisms, will be used for both the effluent and laboratory water tests. Four of the chambers will serve as the actual experimental chambers that will provide the counts of surviving organisms. The fifth chamber of each test concentration will be used as a "chemistry control." Routine test measurements such as temperature, DO, and pH will be taken from the chemistry controls to reduce the possibility of cross-contamination of test solutions due to the use of instrument probes during routine test maintenance. Test organisms for both the effluent and the laboratory tests will be added at the same time (within 0.5 hour). The two tests (effluent/receiving stream and laboratory water) will then be conducted so that there are no differences other than the composition of the water matrix and the Zn concentrations. Tests will be maintained and test organism effects/symptoms will be observed and recorded as specified in EPA (2002).

For test solution renewal at 24 hours (if needed), a fresh set of exposure solutions will be prepared and transferred to clean test chambers in the same way as described above. Aliquots of the new solutions will be retained for the analysis of Zn as described in Section 3.0. Test organisms from the old solutions will then be transferred to the new solutions using a pipette. Old solutions from each exposure replicate will be combined into a single aliquot for each test exposure for Zn analysis as described in Section 3.0.

For non-renewal tests, aliquots of the test solutions will be retained for the analysis of total dissolved Zn at the beginning and at the end of the test as described in Section 3.0.

Test conditions for *C. dubia* and *P. promelas* based on EPA (2002) are summarized in Tables 2.1 and 2.2, respectively.

2.4.3 Combined Metal Tests

As previously noted testing and analysis to develop the CuWER is part of a concurent study to develop a WER-based site specific criterion for Zn which must follow EPA (1994). Page 135 of EPA (1994) states that when WERs for more than 1 metal are being developed

"...one or more toxicity test must be conducted at the end to show that the combination of all metals at their proposed new site-specific criteria is acceptable." Accordingly, an additional test will be conducted using the primary test species in effluent spiked to levels of Cu and Zn equal to the proposed criteria. The proposed criteria will be based on Cu and Zn criteria values (10.99 and 96.81 µgt/L, respectively), which are the criteria values used the determination of permit limits per page 14 of the Fact Sheet for AR00400967. The test will be an acute, 48 hour test using the proposed criteria as a midpoint in the concentration series with two additional concentrations higher and lower than the midpoint with a 0.6 dilution factor separating concentrations.

Table 2.1. Summary of test conditions for definitive acute test using *Ceriodaphinia dubia.*

Test type	Static non-renewal
Test duration	48 hour
Temperature	25°C ±1°C
Light quality	Ambient laboratory illumination
Light intensity	Ambient laboratory levels
Photoperiod	16 h light, 8 h darkness
Test chamber size	30 mL
Test solution volume	15 mL
Renewal of test solutions	See Text
Age of test organisms	Less than 24 (required)
Number organisms per test chamber	5
No. replicate chambers per concentration	4
No. organisms per concentration	20
Feeding regime	Feed YCT and *Selenastrum* while holding prior to the test
Test chamber cleaning	Cleaning not required
Test chamber aeration	None
Dilution Water	See Text
Test Concentrations	See Text
Dilution Series	0.65 dilution factor
Endpoint	Mortality
Sampling and sample holding requirements	Grab or composite sample first used within 36 hours of completion of the sampling period (required)
Test Acceptability Criterion	See Text

Table 2.2. Summary of test conditions for definitive acute test using *Pimephales promelas*.

Test type	Static non-renewal
Test duration	48 hour
Temperature	25°C ±1°C
Light quality	Ambient laboratory illumination
Light intensity	Ambient laboratory levels
Photoperiod	16 h light, 8 h darkness
Test chamber size	250 mL
Test solution volume	200 mL
Renewal of test solutions	See Text
Age of test organisms	1-14 days; less than or equal to 24-h range in age
Number organisms per test chamber	10
No. replicate chambers per concentration	2
No. organisms per concentration	20
Feeding regime	None
Test chamber cleaning	Cleaning not required
Test chamber aeration	None
Dilution Water	See Text
Test Concentrations	See Text
Dilution Series	0.65 dilution factor
Endpoint	Mortality
Sampling and sample holding requirements	Grab or composite sample first used within 36 hours of completion of the sampling period (required)
Test Acceptability Criterion	See Text

3.0 CHEMICAL AND OTHER MEASUREMENTS

Effluent samples collected for each series of tests (including range-finding tests and definitive tests) will be analyzed for the parameters listed in Table 3.1[5]. This parameter list includes routine NPDES permit parameters that are analyzed to document plant operating conditions.

Table 3.1. Analytical parameters for effluent sample and laboratory water used for WER testing.

Parameter	Analytical Method	Reporting Limit (mg/L)
Total Recoverable Copper *	EPA 200.8	0.006
Dissolved copper *	EPA 200.8	0.006
Total Recoverable Zn *	EPA 200.8	0.006
Dissolved Zn *	EPA 200.8	0.006
Fecal Coliform Bacteria**	SM 9221, 9222	10 CFU/100mL
Total ammonia	SM 4500 NH3-E	0.1
pH **	HydroLab meter	Not applicable
Dissolved Oxygen **	HydroLab meter	0.5
Temperature **	HydroLab meter	Not applicable
Total Organic Carbon *	EPA 415.1	1.0
Hardness*	EPA 130.1	1.0
Total Alkalinity*	EPA 310.2	10
Dissolved Organic Carbon *	EPA 415.1	1.0
TSS *	EPA 160.2	4.0
CBOD5 *	EPA 405.1	2.0

*Parameters also to be measured in laboratory water.
** Measured in effluent at the time of sample arrival to the laboratory.

Samples for the analysis of Zn will be collected from each concentration at the beginning and end of each 24-hour period. The sample for the end of a 24-hour period (and/or end of the test, as appropriate) for a particular test concentration will be collected by combining all four replicates into a single composite. A portion of the composite will then be filtered through a 0.45 µ membrane filter to be used for determining dissolved Zn concentration. The preserved Zn

[5] This table differes from the Table 3.1 in the WER plan for Cu because the Cu WER plan included measurements of additional parameters to perform biotic ligand model calculations.

samples will be analyzed as a single batch at the end of the test. Analyses will be conducted only on those concentrations necessary for LC50 calculations.

4.0 DATA QUALITY OBJECTIVES

Toxicity testing, analytical procedures, and results will undergo Quality Assurance/Quality Control (QA/QC) review as specified in AIC's written QA/QC procedures. Toxicity test acceptance criteria are summarized in Table 4.1. Acceptance criteria for chemical analyses are provided in Table 4.2[6]. Toxicity tests that do not meet acceptance criteria will not be considered valid for the study purposes. Chemical analyses that do not meet acceptance criteria will be repeated, if possible. The need to invalidate testing based on failure to meet acceptance criteria for chemical analyses will be determined, with agency consultation, based on the type and severity of the failure. Toxicity and analytical tests may also be invalidated for additional reasons identified during the routine QA/QC review performed by AIC.

Table 4.1. Acceptance criteria for toxicity tests.

Test Parameter	Acceptance Criterion
Temperature	25°C ± 1°C [1]
DO	> 6 mg/L in all test concentrations [2]
pH	6.5 – 8.5 su [2]
Performance control survival	≥ 90% [1,3]
Unspiked effluent control	≥ 90% [3]
Percent decrease in dissolved metal concentration between initial and final measurements	< 50% [3]
Percent of adversely affected organisms in laboratory water test	> 50% in at least one test concentration[3]
Percent of adversely affected organisms in effluent test	< 50% in at least one test concentration[3]
Dose response	Inverted dose response does not affect more than two concentrations having between 20% and 80% mortality[3]

Notes:
1. Based on EPA (2002).
2. Based on typical levels observed during routine biomonitoring.
3. Based on EPA (1994).

[6] This table differs from the Table 4.2 in the WER plan for Cu because the Cu WER plan included measurements of additional parameters to perform biotic ligand calculations.

Table 4.2. Acceptance criteria for chemical analyses.

Analytical Parameter	Analytical Method	Quality Control Parameter Duplicate RPD	LCS % Recovery	Laboratory Blank (mg/L)
Total Copper	200.8	$\pm$ 20%	85 - 115%	<0.006
Dissolved Copper	EPA 200.8	$\pm$ 20%	NA	<0.006
Total Zn	EPA 200.8	$\pm$ 20%	85 - 115%	<0.006
Dissolved Zn	EPA 200.8	$\pm$ 20%	NA	<0.006
Total Organic Carbon	EPA 415.1	$\pm$ 20%	85 - 115%	<1.0
Dissolved Organic Carbon	EPA 415.1	$\pm$ 20%	NA	<1.0
Total Alkalinity	EPA 310.2	$\pm$ 20%	N/A	<1.0
Hardness	EPA 130.1	$\pm$ 20%	85 - 115%	<1.0
TSS	EPA 160.2	$\pm$ 20%	NA	<4.0
BOD_5	EPA 405.1	$\pm$ 20%	NA	<2.0

5.0 CALCULATING AND INTERPRETING RESULTS

LC50 values will be calculated using probit analysis or computational interpolation (e.g., trimmed Spearman-Karber) using time-weighted average concentrations if the data allow. LC50 and WER computations will be carried out to at least four significant digits to avoid rounding errors.

The measurement of both total and dissolved Zn in the tests will allow calculation of both a total and dissolved WER calculated per EPA (1994) as follows:

1. Normalize the LC50s from the laboratory water and the site water to the same hardness using Formula 1.1;
2. Calculate the sample WER from LC50 values normalized to the same hardness by dividing the hardness-normalized site water LC50 by the hardness-normalized laboratory water;
3. The final site WER will be calculated using the decision tree on page 36 of EPA (1994).

6.0 REPORTING THE RESULTS

A report of the results will be prepared containing, at a minimum, the information required by Method 1, Section J, EPA (1994). The report will include summary tables that identify the measured total and dissolved Zn concentrations in each test solution aliquot (laboratory water, simulated downstream water, and 100% effluent) at test initiation and test termination (and during any renewals), along with percent survival for each of the WER tests conducted. The report will also include appendices with copies of the sample custody reports, the bioassay data sheets, the laboratory analytical reports, statistical analysis inputs/outputs records local precipitation and effluent and receiving stream flows[7].

[7] Local precipitation and receiving stream flows for Lee Creek at Lee Creek Reservoir are available from the USGS monitoring station 07250085 near Van Buren, AR approximately 1.2 miles upstream of Outfall 001.

7.0 LITERATURE CITED

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EPA. 1985. *Ambient Water Quality Criteria for Zn* [EPA-440/5-80-057]. Office of Water Regulations and Standards, Washington, D.C.

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EPA. 1994. *Interim Guidance on Determination and Use of Water-Effect Ratios for Metals* [EPA-823-B-94-001]. US Environmental Protection Agency, Office of Water. Washington, DC. February 1994.

EPA. 1997. Modifications to Guidance: Site-specific Criteria. Technical Memorandum from Jeanette Wiltse, Director, Health and Ecological Criteria Division,]. US Environmental Protection Agency, Washington, DC. November 1997.

APPENDIX A

ADEQ Summary Letter

VAN BUREN MUNICIPAL UTILITIES

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September 25, 2012

Mr. Kevin Suel
Enforcement Analyst
Water Division Enforcement Branch
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5301 Northshore Drive
North Little Rock, AR 72118-5317

Re: NPDES AR0040967, AFIN: 17-00565
Van Buren, Arkansas, North Plant
Copper and Zinc

Dear Mr. Suel:

Per our telephone conversation on September 18, 2012;

1. WER Work Plan

The Van Buren Municipal Utilities has contracted with FTN Associates Ltd. for the preparation and submittal to the ADEQ of a work plan for the development of Water Effect Ratios for Copper and Zinc. (Copy of agreement attached)

2. Summary of Van Buren Municipal Utilities efforts to date to locate sources of influent Copper and Zinc into the North Plant.

Please see attached letter dated September 19, 2012 from C. Larry Weir, P.E., Van Buren Municipal Utilities Commission Engineer.

Based on past correspondence and conversation, the Van Buren Municipal Utilities requests the following consideration;

1. Before undergoing the expense of developing the Water Effect Ratios for Copper and Zinc we wish to know if ADEQ will consider revising the effluent limits for

Copper and Zinc at the North Plant should the attached summary and Work Plan be approved, and the WERs show cause for reduction of limits.

2. We wish to know if there is a procedure or methodology that would allow the ADEQ to remove the Copper and Zinc Limits based on the North Plant discharging into the backwaters of the Arkansas River as previously discussed.

Thank you in advance for these considerations, please contact me if you should have any questions or need further information.

Respectfully,
Steve Dufresne
Steve Dufresne
Director of Utilities

Cc: file
Darel Manus, Operations Superintendent
Larry Weir, P.E., Commission Engineer

EXHIBIT A

Scope of Work for Basic Services
Proposal to Develop Technical Justification for
Water-Effects Ratios for Copper and Zinc

This exhibit is attached to and made part of this Letter Agreement dated September 21, 2012, between FTN Associates, Ltd. (FTN) and Van Buren Municipal Utilities (Client). The 2 tasks of this scope will be to develop water-effects ratios for Cu and Zn. This cost proposal assumes that the supporting data for the Cu WER can be developed using EPA's "streamlined" WER guidance (EPA, 2001)[1] while the supporting data for the Zn WER will be developed using the "interim guidance (EPA, 1994)[2]. The tasks expected to be included in this project are as follows:

TASK 1 PREPARATION AND SUBMITTAL OF WORK PLANS

TASK 1.1 PREPARATION OF COPPER WORK PLAN

FTN will prepare a Draft Work Plan that describes the type, quantity and quality of technical data required to support the Cu WER as well as the required information for the Justification Report. FTN will submit the Draft Work Plan to the Client for review and revise the draft per the Client's review and comment. The data collection and analysis for the Cu WER will follow requirements in EPA's "streamlined" WER guidance (EPA 2001). FTN will submit the draft to ADEQ for review and revise the plan according to comments as necessary to produce Final Work Plan. ADEQ might seek comment and review from Region 6 EPA.

TASK 1.2 PREPARATION OF ZINC WORK PLAN

FTN will prepare a Draft Work Plan that describes the type, quantity and quality of technical data required to support the Zn WER as well as the required information for the Justification Report. FTN will submit the Draft Work Plan to the Client for review and revise the draft per the Client's review and comment. The data collection and analysis for the Zn WER will follow requirements in EPA's original WER guidance (EPA 1994). FTN will submit the draft to ADEQ for review and revise the plan according to comments as necessary to produce Final Work Plan. ADEQ might seek comment and review from Region 6 EPA.

Task 1 lump sum fee:[redacted]

[1] EPA. 1994. Interim guidance on determination and use of water-effect ratios for metals. United States Environmental Protection Agency, Office of Water, EPA-823-B-94-001, February, 1994.

[2] EPA. 2001. Streamlined water-effect ratio procedure for discharges of copper. United States Environmental Protection Agency, Office of Water, EPA-822-R-01-005, March, 2001.

C. Larry Weir, Professional Engineer

Licensed Civil Engineer - Arkansas, Oklahoma, Georgia and Missouri

September 19, 2012

Mr. Steve Dufresne
Director of Utilities
Van Buren Municipal Utilities
2806 Bryan Road
Van Buren, AR 72956

Re: North Plant AR0040967
Recoverable Copper and Zinc

Dear Mr. Dufresne:

This letter is written in response to our discussions about the efforts of the Van Buren Municipal Utilities to identify the sources of the excessive contributions of copper and zinc to the North Plant collection system deemed to be the cause of the plant's failure to meet specified discharge limits.

As you are aware, the permit referenced by number above set forth limits for total recoverable copper of 9.2 μg (monthly average) and 18.5 μg (7-day average). The limits for zinc were similarly set at 85.5 μg and 171.6 μg.

It was recognized that the subject plant is in a collecting drainage basin that is largely domestic contributors but does include some commercial contributors, those being a commercial truck wash, car washes, as well as retail facilities, auto repair, schools, and so forth.

Our initial thoughts were to confirm the accuracy of our testing results. The laboratory had heretofore been reporting metals contributions in mg/l and there was a need to confirm the detection limits. In January of 2008, a series of influent and effluent tests were recommended and performed at the plant

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c.l.weir@sbcglobal.net

for this purpose enlisting the independent testing of another contract laboratory, American Interplex.

A series of samples and testing was performed to determine the typical background wastewater concentrations of copper and zinc from collection areas that are only residential and those that included typical commercial sources. Samples were also tested from the commercial truck wash as well as from car washes.

From August of 2009 through June of 2010, the Utility collected samples from various lines carefully moving up the collection system with the intentional object of locating or eliminating sources. During that time samples of influent and effluent were collected at the treatment plant to determine if peaks of discharged metals were reflected in the plant. Generally the removal efficiency at the treatment plant was noted to be 50.4% for copper and 42.9% for zinc.

Our efforts to locate a definitive source were not successful. The pretreatment coordinator had previously surveyed the collection system for potential contributors but then, in July of 2010, visited and interviewed those likely commercial contributors along the lines for potential other sources. Those interviewed and inspected included Wal-Mart, Lowes, mechanic and body shops, tire shops, and so on. The investigation also included an overview check of chemicals being used for cleaning and waxes that may be discharged routinely to the sewer. Although all were cooperative with an explanation of the difficulties, nothing definitive was determined or located.

We have interviewed the City of Fort Smith, Van Buren's water supplier, and determined that the Fort Smith water supply has a normal copper and zinc concentration of 0.31 µg and 4.9 µg respectively. The drinking water has a maintained pH range of 8.5-9 with an observed average of around 8.3.

The North Plant does not receive hauled wastes for treatment nor is the discharge of haulers allowed within the system. The Utility is not aware of instances of illegal or otherwise approved discharges that would explain the contributions of copper and zinc to the system.

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A point has been made that the discharge of the North Plant to Lee Creek is at an elevation that is below the normal pool elevation of the Arkansas River and consideration was requested for leniency in the discharge limits based on this discharge point being backwater. We are unable to contend that Lee Creek is not intermittent at some times of the year although the Arkansas River does maintain a pool at the location of the discharge.

The Utilities bio-monitoring has not shown there to be a problem with the plant's effluent from that standpoint. In lieu of additional expense, the Utility wishes to verify that the limits are necessary to the extent that they have been set. It is understood that additional specific testing can be performed to establish the limits that would be toxic. The Utility has investigated the determination of the Water Effects Ratio (WER) for both copper and zinc discharges and has discussed this procedure in some depth with FTN Associates. To date FTN has determined from sampling and evaluation that Biotic Ligand Model indicates positive results for justification of higher limits for copper based on the WER. It is possible that a similar circumstance may hold true for Zinc although a model is not readily available for Zinc.

While there is some expense involved with the WER evaluation, it is believed the potential to be far more cost effective to the alternatives of treatment or relocating the discharge from this plant. Another alternative is the continuation of sampling of the collection system in a systematic source of the copper and zinc contributions which may have background domestic points of origin that are not controllable.

Respectfully,

C. Larry Weir, P.E.

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STEVE DUFRESNE
VAN BUREN MUNICIPAL UTILITIES

P. O. DRAWER 1269
VAN BUREN, AR 72957

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Mr. Kevin Suel
Enforcement Analyst
Water Division Enforcement Branch
Arkansas Department of Environmental Quality
5301 Northshore Drive
North Little Rock, AR 72118-5317

APPENDIX B

ADEQ Pretreatment Program Audit and Municipal Pollution Prevention Assessment

ADEQ

ARKANSAS
Department of Environmental Quality

July 10, 2012

Gary Smith, Director of Utilities
City of Van Buren
P O Box 1269
Van Buren, AR 72956

Re: City of Van Buren (AFIN: 17-00062 NPDES Permit Number: AR0021482)
Pretreatment Program Audit & Municipal Pollution Prevention (P2) Assessment

Dear Mr. Smith:

Please find enclosed the finished report for the audit/assessment conducted by the Department from June 19th through 21st, 2012. The report should be made available for review by appropriate industrial and City officials. The Van Buren staff should discuss and evaluate the findings in this report. Please respond to the required actions and recommendations in writing within thirty (30) days.

The Department appreciates the staff's assistance. The staff appeared very interested in both the Pretreatment and Pollution Prevention Programs. Most of the recommendations in the attached audit/assessment are intended to aide the City's pretreatment program with achieving the objectives of the Clean Water Act.

If the City has questions or concerns, please do not hesitate to contact the Department at (501) 682-0626 or torrence@adeq.state.ar.us .

Sincerely,

Rufus J. Torrence

Rufus J. Torrence, Water Division Engineer

Encl: Audit Report/Assessment Checklist

Cc: Rudy Molinda / EPA 6WQ-PM (via e-mail w/o attmt)
Eric Fleming / Mgr-Field Services (w/o attmt)

PRETREATMENT PROGRAM AUDIT/

POLLUTION PREVENTION ASSESSMENT

CITY OF VAN BUREN, ARKANSAS

NPDES PERMIT #AR0021482

July 10, 2012

PREPARED BY: Rufus Torrence

ADEQ Water Division Engineer and Auditor

ARKANSAS DEPARTMENT OF ENVIRONMENTAL QUALITY

5301 Northshore Drive

NORTH LITTLE ROCK, ARKANSAS 72118-5317

Van Buren's Pretreatment Program was originally approved 10/1/81. Subsequent modifications were submitted, approved and incorporated into the City's NPDES permit on 3/21/90, on 3/6/97 and recently on 3/18/2011. These modifications included changes in the City's Pretreatment Ordinance, headworks loading evaluation and minor program narrative revisions. The City recently updated the pretreatment program to comply with the recent revisions to 40 CFR Part 403. These revisions are commonly referred to as the "Streamlining" updates.

The City has three (3) wastewater treatment plants. The main (South) POTW design flow was increased to 4.0 MGD. The South Plant has a screening unit, two 60' diameter secondary clarifiers, UV disinfection unit, flow monitoring equipment, and standby power source. The old aerated lagoon was modified to an activated sludge unit consisting of two aerated basins (combined surface area of 56,292 square feet), aerobic sludge storage (surface area of 46,354 square feet), and an equalization basin (surface area 167,777 square feet). Eight (8) significant (four are categorical) industrial users (SIUs) contribute about 0.70 millions gallons each day to the POTW. The South POTW discharges into the Arkansas River. The POTW effluent has exhibited no toxicity to aquatic life. Constructing and upgrading the plant, the City dredged the lagoon and land applied the sludge in July 2008 on nearby City-owned property. The sludge had low metal content (Copper at 13 mg/kg and Zinc at 54 mg/kg).

The Lee Creek POTW is a simple activated sludge package treatment plant operating under extended aeration conditions. This POTW design flow is 0.04 MGD. The POTW has no significant industrial user contributions and accepts only sanitary wastewater from Bekaert Steel, a nearby ball park and an I-40 rest area. The POTW treated effluent is chlorine disinfected and discharged to the Arkansas River. Accumulated sludge is wasted to an aerated holding digester and periodically transported to the North POTW.

The North POTW is a closed loop reactor, has a 2 channel orbal design, and has an oxidation ditch with 2 stage clarification. A non-categorical SIU contributes about 10,000 gallons each day to the POTW. The POTW design flow is 2.0 MGD and discharges to Lee Creek. The POTW effluent is disinfected in a UV contact chamber and discharged to the creek. The POTW effluent has exhibited no toxicity to aquatic life. Biosolids are periodically dredged and land applied on City property.

Effective on 3-1-11, the North Plant has permit limits for Copper (9.2 μg/l) and Zinc (85.5 μg/l). Monitoring results submitted to ADEQ indicate a pattern of violations for both metals. Since the North plant has only one significant industrial user (Arkansas Valley Truck Wash), the source of the metals appear to be from domestic users. The City should be aware that the pretreatment program will probably not be placed in SNC (significant noncompliance) for pass through ("pass through" is limited to non-domestic sources) if the North plant continues to violate the effluent metal limits. However, ADEQ enforcement has expressed concerns for violating the NPDES permit limits (See Attachment I-1/3 for more details).

The audit/assessment consisted of informal discussions with the City's Pretreatment Coordinator, examination of industrial user files, pretreatment records and site visits to five (5) industrial users. The auditor utilized a checklist to ensure that all facets of the program were evaluated. A copy of the completed checklist is attached. Additional information obtained during the audit is included as Attachments

The report is divided into three sections. Section B provides a summary of the significant findings of the audit which will require action by the City. Section C includes recommendations to help improve the implementation and enforcement of their Pretreatment and Pollution Prevention Programs. Finally, required program modifications to the City's approved program, including its adopted legal authorities, are outlined in Section D.

B) SUMMARY OF FINDINGS WITH REQUIRED ACTIONS

This section of the report is a summary of deficiencies found in the City of Van Buren's Pretreatment Program. The auditor has paraphrased with CFR citations the actions required by the City to comply with the current General Pretreatment Regulations (40 CFR 403) and with the approved program. A narrative explanation of the finding will follow the citations.

1) Under ***40 CFR Part 408.5(f)(4)*** find "*The POTW shall develop local limits as required in §403.5(c)(1), or demonstrate that they are not necessary.*

The City's North plant has permit limits for Copper (9.2 ug/l) and Zinc (85.5 ug/l) which became effective on March 1, 2011. The permit limits are included to prevent pass through to the receiving stream (Lee Creek). The Copper and Zinc in the North plant effluent are consistently higher than WQS for the receiving stream and, hence, the plant is consistently in violation of the NPDES permit limits for Copper and Zinc. The North plant is not designed to remove Copper or Zinc.

The North plant has only one significant industrial user. The metals in the influent appear to originate from domestic sources (see Attachment L-6/14) as the metal levels in the influent are typical for domestic wastewater. Local limits apply to non-domestic sources only. ADEQ has provided the City with guidance (see Attachment K-1/6) which indicates that local limits for toxic and conventional pollutants are not necessary for the City's two main POTWs. Nonetheless, the City has a <u>Duty to Comply</u> with the NPDES permit limits and must take steps to remedy the violations. In a letter dated March 13, 2012, the Department required the City to work toward compliance (see Attachment I-1/3). Finally, the City must either develop local limits for all pollutants of concern or confirm that local limits are not necessary (see Recommendation #1 & #4 below for more details).

C) RECOMMENDED POTW ACTIONS FOR IMPROVED IMPLEMENTATION OF THE PRETREATMENT AND POLLUTION PREVENTION PROGRAMS

1) The Department will not require the City to develop local limits at this time. Based on the influent loading data shown in Attachment K-3/6, the conventional pollutant loadings to the South average only about half of the design capacity. Since the metals enter the South and North plant at domestic levels, local limits for metals at both plants appear unnecessary. However, the Department recommends that the City develop local limits for at least $CBOD_5$ and TSS for the South Plant. Referring to Attachments L-6/14 and L-9/14, the City has demonstrated that local limits are not necessary for Arsenic, Cadmium, Chromium, Copper, Cyanide, Lead, Mercury, Nickel, Selenium, Silver and Zinc as these pollutants enter the POTW below EPA Typical Domestic Levels. The City has no point source for Ammonia.

2) River City Coating permit has a fact sheet which shows the derivation of mass limits. The previous permit had mass limits. Since the present permit does not have mass limits, the City should remove the derivation from the fact sheet. See Attachment F-3/3 for details.

3) The City should consider developing a Water Effect Ratio (WER) for Copper and Zinc for the North Plant. The North Plant is consistently violating the permit limits for Copper and Zinc. A WER greater than 1 will increase the permit limits for Copper and Zinc. The Department has provided the City with guidance and contact information.

4) The South Plant occasionally violates the NPDES permit limits for ammonia. Since the City does not have a point source for ammonia, a local limit for ammonia will not remedy the violations. However, the City can request assistance from point sources of CBOD.

The City influent flow varies considerably over the course of a week. The variation in flow appears to follow the pattern of discharger from the three main hydraulic dischargers (Simmons Poultry, Simmons Food and Tyson Food). The City should consider coordinating the discharges from these three SIUs to level the influent flow and CBOD loading. A steady organic loading may assist the plant with nitrification and dinitrification.

5) Since the Metal Finishers are not significant sources of organic loading, the City should consider removing the BOD and TSS limits from these permits.

APPENDIX E

EPA Comments on WER Study Plans

Responses to comment in italics.

USEPA Region 6 Comments Applicable to the Van Buren Water Effect Ratio (WER) Work Plans for Both Copper and Zinc

1. Section 1.0 Introduction (and Associated Appendices): We really appreciate the amount of effort that was put into these work plans in terms of characterizing the discharge and receiving stream and evaluating source reduction and treatment options. Section 1.0 of these work plans (and associated appendices) provide an excellent example of the kind of background analysis and evaluation desired for WER work plans.

2. Section 1.1, Options Considered: The second to last sentence of Section 1.1 states the following: "Accordingly, VBMU is proposing the study described herein to provide justification for a site-specific criterion for Cu [and Zn] in the portion of Reach 002 of Lee Creek from Lee Creek Reservoir to the mouth of Lee Creek on the Arkansas River." Lee Creek Reservoir appears to be located upstream from VBMU's permitted outfall. It would not be appropriate to apply the site-specific criteria derived from this WER study upstream from the permitted outfall (since the WER study is not designed to represent conditions upstream from the outfall). ADEQ and the facility may wish to consider the following description for where the site-specific criteria would apply: "Lee Creek from the edge of the mixing zone with the Arkansas River upstream to VBMU's permitted outfall in Crawford County, Arkansas." The Texas Commission on Environmental Quality (TCEQ) has used descriptions similar to this one when describing the stream reaches to which WER-based site-specific criteria apply.

   Change made as requested.

3. Section 1.2, Receiving Stream: The recreation and aquatic life use descriptions for Lee Creek Reach 002 should more closely follow those described in Arkansas' WQS. In looking at Appendix A of Arkansas' WQS, it appears that this reach is in the Boston Mountains Ecoregion (Plate BM-1), but it could lie within the Arkansas River Valley Ecoregion (Plate ARV-1) (reach is close to the border between these two ecoregions). Either way, if the watershed size of this reach is >10 square miles, then the uses would be primary contact recreation and perennial [BM or ARV] aquatic life. If the watershed size of this reach is <10 square miles, then the uses would be secondary contact recreation and seasonal [BM or ARV] aquatic life.

   Change made as requested.

4. Section 7.0 Literature Cited (and associated uses of "(EPA 1991)" throughout work plan): A more updated fifth edition of *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms* (October 2002) is available. See: http://water.epa.gov/scitech/methods/cwa/wet/upload/2007_07_10_methods_wet_disk2_atx.pdf

   Change made as requested.

5. Need for Combined Copper and Zinc Toxicity Test: In multiple metal WER studies where a WER is determined for each metal individually (as is the case with this study), page 135 of USEPA's 1994 interim WER guidance states that: "one or more additional toxicity tests **must** be conducted at the end to show that the combination of all metals at their proposed new site-specific criteria is acceptable. Acceptability **must** be demonstrated with each toxicity test that was used as a primary toxicity test in the determination of the WERs for the individual metals." Please modify the work plans to include such a combined test.

   Change made as requested. See sections 1.6 and 2.4.3 of Cu plan; Section 1.5.3 and 2.4.3 of Zn plan

Additional USEPA Region 6 Comments Applicable to the Van Buren WER Work Plan for Copper

6. Section 1.1, Options Considered, page 1-1: (minor edit) In the second paragraph, within the phrase "in an attempt to identify Zn sources…," Zn should be changed to Cu.

   Change made as requested.

7. Table 1.5, page 1-9: The footnote "*Hardness = 50 mg/L" should be revised to "*Hardness = 100 mg/L" since the WER of 8.6 appears to have been determined using the Adjusted LC50 of 207.3 µg/L and the SMAV of 24.00 µg/L, both of which reflect a hardness of 100 mg/L.

   Change made as requested.

8. Section 2.3 Laboratory Test Water, page 2-2: The second sentence in Section 2.3 states that: "The concentration of total organic carbon (TOC) and total suspended solids (TSS) in the laboratory water will be less than 0.5 mg/L and less than 4 mg/L, respectively." While this is fine and revisions to this statement are not necessary, please note that Appendix A, Item D.2 of USEPA's 2001 streamlined copper WER procedure only requires dissolved organic carbon (DOC), TOC, and TSS <5 mg/L.

9. Section 2.4.2, Definitive Tests, page 2-4: We assume that the definitive tests will also be 48-hour tests. However, please clarify this in Section 2.4.2, since the 48-hour test duration is only explicitly stated for the range-finding tests in Section 2.4.1

   Change made as requested.

10. Table 3.1, page 3-1:
    a. Hardness – should the method for hardness be EPA 130.1 rather than 130.0?
    b. Total alkalinity – should the method for total alkalinity be EPA 310.2 rather than 310.0?
    c. DOC – the second row for DOC can be deleted since it is repetitive.

    Change made as requested

Additional USEPA Region 6 Comments Applicable to the Van Buren WER Work Plan for Zinc

11. Section 1.5, Proposed Approach, page 1-8:

    Background–The second paragraph in Section 1.5 states the following: "The proposed approach will use "Method 1" in EPA (1994). This method can be used to determine a WER in the vicinity of a plume or in receiving streams with zero flow (EPA 1994). The critical flow for Outfall 001 is 100%. **Therefore effluent samples will not be mixed with water collected from the receiving stream**" (emphasis added).

    There are important differences between USEPA's 2001 streamlined WER procedure for copper and USEPA's 1994 interim WER guidance. For example, under the copper streamlined procedure, the simulated downstream water constitutes effluent and upstream water mixed at the design low flow dilution ratio (in the case of Van Buren's discharge, this means 100% effluent). However, under the 1994 interim WER guidance, the intent is to ensure that WER sampling events occur within a range of commonly occurring flows. This is to ensure that WERs that are applied at design flow provide adequate protection at higher flows.

To ensure adequate protection over a range of flows, page 35 of the 1994 interim WER guidance states that two types of WERs need to be determined – Type 1 and Type 2 WERs, which are described as follows:

- Type I WERs are determined by obtaining samples of effluent and upstream water when thedownstream flow is between one and two times higher than what it would be under design-flowconditions.
- Type 2 WERs are determined by obtaining samples of effluent and upstream water when thedownstream flow is between two and ten times higher than what it would be under design-flowconditions.

Change made as requested.

Note however: Reach No. 002 of Lee Creek is a tailwater below Lee Creek Dam. Water from Lee Creek Reservoir is normally released from Lee Creek Dam over a concrete spillway. Therefore elevated flows in the receiving stream will not correspond to rainfall events due to the lag time between entry of the storm flow into Lee Creek Reservoir and the overtopping of the spillway. In any case, water that overtops the spillway to flow into the receiving stream will be the same water that was in the reservoir at the time of the event. Therefore, the upstream water to be used for the Type 2 test will be collected from the surface of Lee Creek Reservoir near the spillway without regard to rainfall events. The effluent + receiving stream mix to be used in testing will be based on the median flows recorded at US Geological Survey (USGS) gaging station at Lee Creek Dam (USGS 07250085) using the period of record (POR) from October 1 1993 up to the day of sampling (approximately 95 cfs). The effluent flow used to prepare the effluent + receiving stream mix will be the average flow during the day of sampling and the preceding 2 days. Based on the typical effluent flows the effluent + receiving stream mix to be used in the Type 2 test will be approximately 1 to 2% effluent.

Further, page 36 of the 1994 interim WER guidance provides that three Type I and/or Type 2 WERs must be available in order for a final WER to be calculated and provides a decision tree with a list of options available for completing final WER calculations (options to be considered in sequence such that the option selected is the lowest numbered option whose requirements are satisfied).

<u>Comment</u> – Based on the above information and the discussion beginning at the bottom of page 136 of the 1994 interim WER guidance, USEPA Region 6 recommends that the Van Buren zinc WER study determine three WERs (all based on sampling events spaced at least three weeks apart), as follows:

- two WERs determined using 100% effluent (i.e., Type 1 WERs), and
- one WER determined when elevated flows are present in Lee Creek due to a rainfall event (i.e., Type 2 WER), with the effluent and upstream water to be mixed at the ratio of the flows that exist when the samples are taken.

See added sections 1.5.1 and 1.5.2

The final zinc WER calculations should follow the decision tree provided on page 36 of the 1994 interim WER guidance.

Added item in section 5.0

Note, also, that the following statements in the Van Buren zinc WER work plan (discussing receiving stream flows and timing/seasonality of sampling events) will also likely need to be modified based on the above information and recommendations:

- last paragraph in Section 1.5

- last sentence of the first paragraph in Section 2.0
- first sentence of the second paragraph in Section 2.2

Sections modified.

12. Section 2.1Test Organisms, page 2-1 to 2-2: Section 2.1 indicates that fathead minnow (*Pimephalespromelas*) to be used in testing will be 1 to 24 hours of age at the beginning of the test. Note that both the 4th and 5th editions of *Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms* indicate that use of fathead minnow that are 1-14 days old is acceptable, as long as the test organisms used are within an age range of no more than 24 hours. Also, regarding footnote 3 at the bottom of page 2-1 of the zinc WER workplan, the species mean acute values (SMAVs) for fathead minnow in USEPA's 1980 and 1987 zinc criteria documents, as well as in USEPA's 1995 updates, are all much higher than for the water flea (*Ceriodaphniadubia*). So, while it is possible that the fathead minnow could become the primary test species, it seems more likely that the water flea will be the primary test species.

   Comment noted

13. Section 2.3 Laboratory Test Water, page 2-3: The second sentence in Section 2.3 states that: "The concentration of total organic carbon (TOC) and total suspended solids (TSS) in the laboratory water will be less than 0.5 mg/L and less than 4 mg/L, respectively." While this is fine and revisions to this statement are not necessary, please note thatItem F.2 of USEPA's 1994 interim WER guidance only requires TOC and TSS <5 mg/L.

   Comment noted

14. Section 2.4.1 Range-Finding Tests, page 2-3: Please clarify in the work plan whether range-finding tests will be conducted for both the water flea and fathead minnow.

   Clarification added

15. Section 2.4.2 Definitive Tests, page 2-4: Since there are some variations between the test conditions for the fathead minnow and the water flea (see tables in 12 and 14 in USEPA's 5th edition of *Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms*), it would be helpful to include two tables in this section of the work plan to summarize the respective test conditions for fathead minnow and water flea.

   Tables 2.1 and 2.2 added

16. Table 3.1, page 3-1:
    a. Hardness – should the method for hardness be EPA 130.1 rather than 130.0?
    b. Total alkalinity – should the method for total alkalinity be EPA 310.2 rather than 310.0?
    c. Please clarify why Table 3.1 in the copper WER work plan includes sodium, potassium, chloride, and sulfate, but Table 3.1 in the zinc WER work plan does not.

   Method numbers changed.
   Added explanatory footnote on page 3-1

17. Table 4.2, page 4-2: Please clarify why Table 4.2 in the zinc WER work plan differs from Table 4.2 in the copper WER work plan.

    Added explanatory footnote on page 4-1

18. Section 5.0 Calculating and Interpreting Results, Step 3, page 5-1: As noted in Comment 11 above, the final zinc WER calculations should follow the decision tree on page 36 of the 1994 interim WER guidance.

    Clarification added.

APPENDIX F

Laboratory Reports for Copper WER Testing

June 14, 2013

Test Results of Acute 48 hour Non-Renewal Biomonitoring Testing for

168015-1: NPE01 Copper
168015-3: Moderately Hard water Copper
168015-5: NPE01 Zinc
168015-7: Moderately Hard water Zinc
168015-9: NPE01 Zinc
168015-11: Moderately Hard water Zinc

Prepared for:

Mr. Pat Downey
FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Prepared by:

AMERICAN INTERPLEX CORPORATION
8600 Kanis Road
Little Rock, AR 72204-2322

AMERICAN INTERPLEX CORPORATION LABORATORIES

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Re: Acute 48 hour Non-Renewal Biomonitoring utilizing *Ceriodaphnia dubia*
NPE01 Copper - North Plant- Van Buren, AR
Client NPDES Permit No. AR0040967 AFIN#17-00062

Dear Mr. Pat Downey:

Please find enclosed the results of the Water Effects Ratio (WER) range finding tests.
The LC50 data is summarized below:

Ceriodaphnia dubia

	NPE01	Mod. water
Copper	93 ug/L	8.8 ug/L
Zinc	110 ug/L	129 ug/L

Pimephales promelas

	NPE01	Mod. water
Zinc	530 ug/L	530 ug/L

If I can be of further assistance, please feel free to contact me.

AMERICAN INTERPLEX CORPORATION

John Overbey
Laboratory Director

PDF cc: FTN Associates, Ltd.
ATTN: Mr. Pat Downey
pjd@ftn-assoc.com

Dilution Water Samples: Effluent

Analysis	Result
Dissolved oxygen (mg/l)	8.3
pH (standard units)	7.6
Alkalinity (mg/l as CaCO3)	NA
Hardness (mg/l as CaCO3)	NA
Conductivity (umhos/cm)	260
Residual Chlorine (mg/l)	NA

Results Summary: NPE01 Copper

Ceriodaphnia dubia

The *Ceriodaphnia dubia* test was conducted from June 7, 2013 at 1600 to June 9, 2013 at 1520.

Statistical analyses:

NOEC = 50ppb
LC50 = 93.3ppb

Concentration	24 hour % Survival	48 hour % Survival
Control	100	100
6.25ppb	100	100
12.5ppb	100	100
25ppb	100	100
50ppb	100	100
100ppb	100	40.0 *
200ppb	0.00	0.00 *

*Significant difference compared to the control (p=0.05)

Ceriodaphnia dubia
Survival Data

Number of organisms per chamber: 5 | Age of organisms: <24 hours
Volume of test chamber: 30 ml | Volume of test solution: 15 ml

Effluent Concentration		Number of Survivors 24 Hours	Number of Survivors 48 Hours	% Survival	CV %
Control	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
6.25ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
12.5ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
25ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
50ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
100ppb	rep. A	5	2	40.0	81.6
	rep. B	5	0		
	rep. C	5	2		
	rep. D	5	4		
200ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		

CV = Coefficient of variance = standard deviation X 100/mean

Ceriodaphnia dubia

	Transformation of Data		Transform: Arc Sin(Square Root(Y))	
Group	Identification	Rep	Value	Transformed
1	Control	1	1.00000	1.34530
1	Control	2	1.00000	1.34530
1	Control	3	1.00000	1.34530
1	Control	4	1.00000	1.34530
2	6.25ppb	1	1.00000	1.34530
2	6.25ppb	2	1.00000	1.34530
2	6.25ppb	3	1.00000	1.34530
2	6.25ppb	4	1.00000	1.34530
3	12.5ppb	1	1.00000	1.34530
3	12.5ppb	2	1.00000	1.34530
3	12.5ppb	3	1.00000	1.34530
3	12.5ppb	4	1.00000	1.34530
4	25ppb	1	1.00000	1.34530
4	25ppb	2	1.00000	1.34530
4	25ppb	3	1.00000	1.34530
4	25ppb	4	1.00000	1.34530
5	50ppb	1	1.00000	1.34530
5	50ppb	2	1.00000	1.34530
5	50ppb	3	1.00000	1.34530
5	50ppb	4	1.00000	1.34530
6	100ppb	1	0.40000	0.68472
6	100ppb	2	0.00000	0.22551
6	100ppb	3	0.40000	0.68472
6	100ppb	4	0.80000	1.10710
7	200ppb	1	0.00000	0.22551
7	200ppb	2	0.00000	0.22551
7	200ppb	3	0.00000	0.22551
7	200ppb	4	0.00000	0.22551

Ceriodaphnia dubia

Shapiro - Wilk's Test for Normality	Transform: Arc Sin(Square Root(Y))
D = 0.3889	
W = 0.3843	
Critical W = 0.896	(alpha = 0.01, N = 28)
Critical W = 0.924	(alpha = 0.05, N = 28)

Data FAIL normality test (alpha = 0.01).

Steel's Many-One Rank Test — Transform: Arc Sin(Square Root(Y))

Ho:Control<Treatment

Group	Identification	Rank Sum	Critical Value	DF	Sig 0.05
1	Control				
2	6.25ppb	18.00	10.00	4.00	
3	12.5ppb	18.00	10.00	4.00	
4	25ppb	18.00	10.00	4.00	
5	50ppb	18.00	10.00	4.00	
6	100ppb	10.00	10.00	4.00	*
7	200ppb	10.00	10.00	4.00	*

Critical values are 1 tailed (k=6)

Ceriodaphnia dubia

Spearman-Karber Method for Calculating LC50 Values

Concentration	Number Exposed	Number Responding	Proportion Responding	Smoothed Proportion	Smoothed Adjusted Proportion
Control	20	0	0	0	0
6.25	20	0	0	0	0
12.5	20	0	0	0	0
25	20	0	0	0	0
50	20	0	0	0	0
100	20	12	0.6	0.6	0.6
200	20	20	1	1	1

LC50 = 93.3
Upper Confidence Limit = 109
Lower Confidence Limit = 79.84

Variance = 0.001145

Chemical Data for
Ceriodaphnia dubia

Day 1		Control	6.25ppb	12.5ppb	25ppb	50ppb	100ppb	200ppb
DO, mg/l	Initial	8.3	8.5	7.1	8.2	8.4	8.3	8.3
DO, mg/l	Final	7.5	7.9	7.6	7.8	7.8	7.8	7.8
pH, su	Initial	7.6	7.5	7.5	7.5	7.5	7.5	7.5
pH, su	Final	7.7	7.8	7.8	7.7	7.7	7.7	7.8
Conductivity, umho/cm		260	250	250	250	250	250	250

Day 2		Control	6.25ppb	12.5ppb	25ppb	50ppb	100ppb	200ppb
DO, mg/l	Final	7.8	8.0	8.0	7.8	7.9	7.9	8.0
pH, su	Final	7.7	7.7	7.7	7.7	7.7	7.7	7.7

AMERICAN INTERPLEX CORPORATION LABORATORIES

CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

PAGE ___ OF ___

Client: VAN BUREN MUNICIPAL UTILITIES

Project Reference: NORTH PLANT

Project Manager:

Sampled By: [signature]

PO No.:

AIC CONTROL NO: 168015

AIC PROPOSAL NO:

Carrier: Fed-X

Received Temperature C: 2

AIC No.	Sample Identification	Date/Time Collected	GRAB	COMP	WATER	SOIL		NO OF BOTTLES	WER	ANALYSES REQUESTED												Remarks
	NPEO1	6/3-4/13 9:30-9:30AM		X	X			6	X													pH 6.56
																						Field pH calibration
		Container Type						P														on ______ @ ______
		Preservative						NO														Buffer:

G = Glass NO = none P = Plastic S = Sulfuric acid pH2 V = VOA vials N = Nitric acid pH2 H = HCl to pH2 B = NaOH to pH12 T = Sodium Thiosulfate Z = Zinc acetate

Turnaround Time Requested: (Please circle)
NORMAL or EXPEDITED IN ____ DAYS
Expedited results requested by: ____________
Who should AIC contact with questions: ____________
Phone: 479-719-6508 Fax: ____________
Report Attention to: VBFred@aol.com
Report Address to:

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	6/4/13 11:11	FED EX - @ 029865615001294	6/4/13 11:11
Relinquished By:	Date/Time	Received in Lab By:	Date/Time
		[signature]	6-5-13 1130

Comments: PER PAT DOWNEY, FTN ASSOC. 9612019 0298 656 15001294

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Re: Acute 48 hour Non-Renewal Biomonitoring utilizing *Ceriodaphnia dubia*
Moderately Hard water Copper
Client NPDES Permit No. AR0040967 AFIN#17-00062

Dilution Water Samples: Synthetic Moderately Hard Water #3994

Analysis	Result
Dissolved oxygen (mg/l)	7.8
pH (standard units)	8.0
Alkalinity (mg/l as CaCO3)	NA
Hardness (mg/l as CaCO3)	NA
Conductivity (umhos/cm)	300
Residual Chlorine (mg/l)	NA

Results Summary: Moderately Hard water Copper

Ceriodaphnia dubia

The *Ceriodaphnia dubia* test was conducted from June 7, 2013 at 1610 to June 9, 2013 at 1525.

Statistical analyses:

NOEC = 6.25ppb
LC50 = 8.84ppb

Concentration	24 hour % Survival	48 hour % Survival
Control	100	100
3.12ppb	100	100
6.25ppb	100	100
12.5ppb	0.00	0.00 *
25ppb	0.00	0.00 *
50ppb	0.00	0.00 *
100ppb	0.00	0.00 *

*Significant difference compared to the control (p=0.05)

Ceriodaphnia dubia
Survival Data

Number of organisms per chamber: 5
Volume of test chamber: 30 ml
Age of organisms: <24 hours
Volume of test solution: 15 ml

Effluent Concentration		Number of Survivors 24 Hours	48 Hours	% Survival	CV %
Control	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
3.12ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
6.25ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
12.5ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		
25ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		
50ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		
100ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		

CV = Coefficient of variance = standard deviation X 100/mean

Ceriodaphnia dubia

Transformation of Data — Transform: Arc Sin(Square Root(Y))

Group	Identification	Rep	Value	Transformed
1	Control	1	1.00000	1.34530
1	Control	2	1.00000	1.34530
1	Control	3	1.00000	1.34530
1	Control	4	1.00000	1.34530
2	3.12ppb	1	1.00000	1.34530
2	3.12ppb	2	1.00000	1.34530
2	3.12ppb	3	1.00000	1.34530
2	3.12ppb	4	1.00000	1.34530
3	6.25ppb	1	1.00000	1.34530
3	6.25ppb	2	1.00000	1.34530
3	6.25ppb	3	1.00000	1.34530
3	6.25ppb	4	1.00000	1.34530
4	12.5ppb	1	0.00000	0.22551
4	12.5ppb	2	0.00000	0.22551
4	12.5ppb	3	0.00000	0.22551
4	12.5ppb	4	0.00000	0.22551
5	25ppb	1	0.00000	0.22551
5	25ppb	2	0.00000	0.22551
5	25ppb	3	0.00000	0.22551
5	25ppb	4	0.00000	0.22551
6	50ppb	1	0.00000	0.22551
6	50ppb	2	0.00000	0.22551
6	50ppb	3	0.00000	0.22551
6	50ppb	4	0.00000	0.22551
7	100ppb	1	0.00000	0.22551
7	100ppb	2	0.00000	0.22551
7	100ppb	3	0.00000	0.22551
7	100ppb	4	0.00000	0.22551

Ceriodaphnia dubia

Shapiro - Wilk's Test for Normality	Transform: Arc Sin(Square Root(Y))
D = 0	
W = 0	
Critical W = 0.896	(alpha = 0.01, N = 28)
Critical W = 0.924	(alpha = 0.05, N = 28)

Data FAIL normality test (alpha = 0.01).

Steel's Many-One Rank Test — Transform: Arc Sin(Square Root(Y))

Ho:Control<Treatment

Group	Identification	Rank Sum	Critical Value	DF	Sig 0.05
1	Control				
2	3.12ppb	18.00	10.00	4.00	
3	6.25ppb	18.00	10.00	4.00	
4	12.5ppb	10.00	10.00	4.00	*
5	25ppb	10.00	10.00	4.00	*
6	50ppb	10.00	10.00	4.00	*
7	100ppb	10.00	10.00	4.00	*

Critical values are 1 tailed (k=6)

Ceriodaphnia dubia

Graphical LC50 Method

Concentration	Number Exposed	Number Responding	Proportion Responding	Smoothed Proportion	Smoothed Adjusted Proportion
Control	20	0	0	0	0
3.12	20	0	0	0	0
6.25	20	0	0	0	0
12.5	20	20	1	1	1
25	20	20	1	1	1
50	20	20	1	1	1
100	20	20	1	1	1

LC50 = 8.84

Chemical Data for
Ceriodaphnia dubia

Day 1		Control	3.12ppb	6.25ppb	12.5ppb	25ppb	50ppb	100ppb
DO, mg/l	Initial	7.8	7.5	7.8	7.8	7.5	8.0	7.8
DO, mg/l	Final	7.9	7.8	7.9	7.9	7.9	7.9	7.8
pH, su	Initial	8.0	8.0	8.0	8.0	8.0	8.0	8.0
pH, su	Final	7.9	8.0	8.0	8.0	8.0	8.0	8.0
Conductivity, umho/cm		300	320	320	320	320	320	320

Day 2		Control	3.12ppb	6.25ppb	12.5ppb	25ppb	50ppb	100ppb
DO, mg/l	Final	7.7	7.8	7.6	7.9	7.8	7.9	7.8
pH, su	Final	7.9	8.0	8.0	8.0	8.0	8.0	8.0

Title: Van Buren Cu rangefinding Effluent Total
File: VBREFTOT.IN Transform: NO TRANSFORMATION

Spearman - Karber Estimate

Estimated EC50: 106.8700 95% Confidence Interval: (90.4881, 123.2519)
[Variance = 69.8603]
[p1 = p2 true; Unconditional Variance] : (90.1535, 123.5865)
[p1 = p2 true; Conditional Variance] : (90.4881, 123.2519)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	CONTROL	1.0000	1.0000	0.0000
2	6.25	1.0000	1.0000	7.8000
3	12.5	1.0000	1.0000	15.5000
4	25	1.0000	1.0000	25.4000
5	50	1.0000	1.0000	50.9000
6	100	0.4000	0.4000	101.8000
7	200	0.0000	0.0000	203.5000

Title: Van Buren Cu rangefinding Effluent Total
File: VBREFTOT.IN Transform: NO TRANSFORMATION

Trimmed Spearman - Karber		Estimate	VAR	95% C.I.	UNCONDITIONAL 95% C.I.
	10.00%	102.8464	98.3235	(83.41,122.28)	(83.01,122.68)
	20.00%	98.9639	123.0581	(77.22,120.71)	(76.78,121.15)
HIGH CALC	60.00%	insufficient body counts			
LOW CALC	0.00%	106.8700	69.8603	(90.49,123.25)	(90.15,123.59)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	CONTROL	1.0000	1.0000	0.0000
2	6.25	1.0000	1.0000	7.8000
3	12.5	1.0000	1.0000	15.5000
4	25	1.0000	1.0000	25.4000
5	50	1.0000	1.0000	50.9000
6	100	0.4000	0.4000	101.8000
7	200	0.0000	0.0000	203.5000

Title: Van Buren Cu rangefinding Effluent dissolved
File: VBREFDIS.IN Transform: NO TRANSFORMATION

Spearman - Karber Estimate

Estimated EC50: 83.3700 95% Confidence Interval: (70.5844, 96.1556)
[Variance = 42.5544]
[p1 = p2 true; Unconditional Variance] : (70.3232, 96.4168)
[p1 = p2 true; Conditional Variance] : (70.5844, 96.1556)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	CONTROL	1.0000	1.0000	0.0000
2	6.25	1.0000	1.0000	6.5000
3	12.5	1.0000	1.0000	13.0000
4	25	1.0000	1.0000	19.9000
5	50	1.0000	1.0000	39.7000
6	100	0.4000	0.4000	79.4000
7	200	0.0000	0.0000	158.8000

Title: Van Buren Cu rangefinding Effluent dissolved
File: VBREFDIS.IN Transform: NO TRANSFORMATION

Trimmed Spearman - Karber	Estimate	VAR	95% C.I.	UNCONDITIONAL 95% C.I.
10.00%	80.2271	59.8915	(65.06, 95.40)	(64.75, 95.71)
20.00%	77.1944	74.9535	(60.23, 94.16)	(59.88, 94.51)
HIGH CALC 60.00%	insufficient body counts			
LOW CALC 0.00%	83.3700	42.5544	(70.58, 96.16)	(70.32, 96.42)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	CONTROL	1.0000	1.0000	0.0000
2	6.25	1.0000	1.0000	6.5000
3	12.5	1.0000	1.0000	13.0000
4	25	1.0000	1.0000	19.9000
5	50	1.0000	1.0000	39.7000
6	100	0.4000	0.4000	79.4000
7	200	0.0000	0.0000	158.8000

Title: Van Buren Cu rangefinding laboratory total
File: VBRLBTOT.IN Transform: NO TRANSFORMATION

Spearman - Karber Estimate

Estimated EC50: 10.1500 unreliable variance
[p1 = p2 true; Unconditional Variance] : unrel. var.
[p1 = p2 true; Conditional Variance] : unrel. var.

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	CONTROL	1.0000	1.0000	0.0000
2	3.12	1.0000	1.0000	3.6000
3	6.25	1.0000	1.0000	7.3000
4	12.5	0.0000	0.0000	13.0000
5	25	0.0000	0.0000	26.1000
6	50	0.0000	0.0000	52.2000

Title: Van Buren Cu rangefinding laboratory total
File: VBRLBTOT.IN Transform: NO TRANSFORMATION

Trimmed Spearman - Karber	Estimate	VAR	95% C.I.	UNCONDITIONAL 95% C.I.
10.00%	10.1500	unrel. var.	unrel. var.	
20.00%	10.1500	unrel. var.	unrel. var.	
HIGH CALC 100.00%	insufficient body counts			
LOW CALC 0.00%	10.1500	unrel. var.	unrel. var.	

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	CONTROL	1.0000	1.0000	0.0000
2	3.12	1.0000	1.0000	3.6000
3	6.25	1.0000	1.0000	7.3000
4	12.5	0.0000	0.0000	13.0000
5	25	0.0000	0.0000	26.1000
6	50	0.0000	0.0000	52.2000

Title: Van Buren Cu rangefinding laboratory dissolved
File: VBRLBDIS.IN Transform: NO TRANSFORMATION

Trimmed Spearman - Karber	Estimate	VAR	95% C.I.	UNCONDITIONAL 95% C.I.
10.00%	9.5000	unrel. var.	unrel. var.	
20.00%	9.5000	unrel. var.	unrel. var.	
HIGH CALC 100.00%	insufficient body counts			
LOW CALC 0.00%	9.5000	unrel. var.	unrel. var.	

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	CONTROL	1.0000	1.0000	0.0000
2	3.12	1.0000	1.0000	3.4000
3	6.25	1.0000	1.0000	6.4000
4	12.5	0.0000	0.0000	12.6000
5	25	0.0000	0.0000	25.3000
6	50	0.0000	0.0000	50.0000

AMERICAN INTERPLEX CORPORATION LABORATORIES

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

This report contains the analytical results and supporting information for samples submitted on June 7, 2013. Attached please find a copy of the Chain of Custody and/or other documents received. Note that any remaining sample will be discarded two weeks from the original report date unless other arrangements are made.

This report is intended for the sole use of the client listed above. Assessment of the data requires access to the entire document.

This report has been reviewed by the Laboratory Director or a qualified designee.

John Overbey
Laboratory Director

This document has been distributed to the following:

PDF cc: FTN Associates, Ltd.
ATTN: Mr. Pat Downey
pjd@ftn-assoc.com

AMERICAN INTERPLEX CORPORATION LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

SAMPLE INFORMATION

Project Description:
One (1) water sample(s) received on June 7, 2013

Receipt Details:
A Chain of Custody was not provided with the sample(s).

Each sample container was checked for proper labeling, including date and time sampled. Sample containers were reviewed for proper type, adequate volume, integrity, temperature, preservation, and holding times. Any exceptions are noted below:

Sample Identification:

Laboratory ID	Client Sample ID	Sampled Date/Time	Notes
168068-1	Effluent		
168068-2	Mod Water		
168068-3	12.5 ppb Cu C. dubia Initial Effluent		
168068-4	100 ppb Cu C. dubia Initial Effluent		
168068-5	6.25 ppb Cu C. dubia Initial Mod		
168068-6	50 ppb Cu C. dubia Initial Mod		
168068-7	37.5 ppb Zn C. dubia Initial Effluent		
168068-8	300 ppb Zn C. dubia Initial Effluent		
168068-9	18.8 ppb Zn C. dubia Initial Mod		
168068-10	150 ppb Zn C. dubia Initial Mod		
168068-11	93.8 ppb Zn P.Promelas Initial Effluent		
168068-12	750 ppb Zn P.Promelas Initial Effluent		
168068-13	46.9 ppb Zn P.Promelas Initial Mod		
168068-14	750 ppb Zn P.Promelas Initial Mod		
168068-15	12.5 ppb Cu C. dubia Final Effluent		
168068-16	100 ppb Cu C. dubia Final Effluent		
168068-17	6.25 ppb Cu C. dubia Final Mod		
168068-18	50 ppb Cu C. dubia Final Mod		
168068-19	37.5 ppb Zn C. dubia Final Effluent		
168068-20	300 ppb Zn C. dubia Final Effluent		
168068-21	18.8 ppb Zn C. dubia Final Mod		
168068-22	150 ppb Zn C. dubia Final Mod		
168068-23	93.8 ppb Zn P.Promelas Final Effluent		
168068-24	750 ppb Zn P.Promelas Final Effluent		
168068-25	46.9 ppb Zn P.Promelas Final Mod		
168068-26	750 ppb Zn P.Promelas Final Mod		

Qualifiers:
D Result is from a secondary dilution factor

References:
"Methods for Chemical Analysis of Water and Wastes", EPA/600/4-79-020 (Mar 1983) with updates and supplements EPA/600/5-91-010 (Jun 1991), EPA/600/R-92-129 (Aug 1992) and EPA/600/R-93-100 (Aug 1993).
"Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846)", Third Edition.
"Standard Methods for the Examination of Water and Wastewaters", 21st edition.
"American Society for Testing and Materials" (ASTM).
"Association of Analytical Chemists" (AOAC).

AMERICAN INTERPLEX CORPORATION LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 168068-1
Sample Identification: Effluent

Analyte	Prep	Result	RL	Units	Qualifier
Alkalinity as CaCO3 SM 2320 B		**38** Analyzed: 07-Jun-2013 0918 by 93	1	**mg/l** Batch: W43834	
Total Organic Carbon SM 5310 C	Prep: 07-Jun-2013 1440 by 302	**4.3** Analyzed: 08-Jun-2013 1236 by 302	1	**mg/l** Batch: W43838	
Calcium EPA 200.7	Prep: 12-Jun-2013 1211 by 305	**22** Analyzed: 12-Jun-2013 1605 by 305	0.1	**mg/l** Batch: S34814	
Magnesium EPA 200.7	Prep: 12-Jun-2013 1211 by 305	**3.6** Analyzed: 12-Jun-2013 1605 by 305	0.03	**mg/l** Batch: S34814	
Potassium EPA 200.7	Prep: 12-Jun-2013 1211 by 305	**4.5** Analyzed: 12-Jun-2013 1605 by 305	1	**mg/l** Batch: S34814	
Sodium EPA 200.7	Prep: 12-Jun-2013 1211 by 305	**19** Analyzed: 12-Jun-2013 1605 by 305	1	**mg/l** Batch: S34814	
Copper EPA 200.8	Prep: 07-Jun-2013 1029 by 235	**3.98** Analyzed: 07-Jun-2013 1122 by 305	1	**ug/l** Batch: S34780	
Zinc EPA 200.8	Prep: 07-Jun-2013 1029 by 235	**20.1** Analyzed: 07-Jun-2013 1122 by 305	2	**ug/l** Batch: S34780	
Chloride EPA 300.0	Prep: 07-Jun-2013 1353 by 07	**19** Analyzed: 07-Jun-2013 2026 by 302	0.2	**mg/l** Batch: S34785	
Sulfate EPA 300.0	Prep: 07-Jun-2013 1353 by 07	**17** Analyzed: 07-Jun-2013 2026 by 302	0.2	**mg/l** Batch: S34785	
Dissolved Organic Carbon SM 5310 C	Prep: 07-Jun-2013 1441 by 302	**3.3** Analyzed: 08-Jun-2013 0056 by 302	1	**mg/l** Batch: W43838	
Dissolved Copper EPA 200.8	Prep: 07-Jun-2013 1029 by 235	**3.88** Analyzed: 07-Jun-2013 1117 by 305	1	**ug/l** Batch: S34780	
Dissolved Zinc EPA 200.8	Prep: 07-Jun-2013 1029 by 235	**20.1** Analyzed: 07-Jun-2013 1117 by 305	2	**ug/l** Batch: S34780	

AIC No. 168068-2
Sample Identification: Mod Water

Analyte	Prep	Result	RL	Units	Qualifier
Alkalinity as CaCO3 SM 2320 B		**57** Analyzed: 07-Jun-2013 0918 by 93	1	**mg/l** Batch: W43834	
Total Organic Carbon SM 5310 C	Prep: 07-Jun-2013 1440 by 302	**< 1** Analyzed: 08-Jun-2013 0116 by 302	1	**mg/l** Batch: W43838	
Calcium EPA 200.7	Prep: 12-Jun-2013 1211 by 305	**13** Analyzed: 12-Jun-2013 1608 by 305	0.1	**mg/l** Batch: S34814	
Magnesium EPA 200.7	Prep: 12-Jun-2013 1211 by 305	**12** Analyzed: 12-Jun-2013 1608 by 305	0.03	**mg/l** Batch: S34814	
Potassium EPA 200.7	Prep: 12-Jun-2013 1211 by 305	**2.2** Analyzed: 12-Jun-2013 1608 by 305	1	**mg/l** Batch: S34814	

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ANALYTICAL RESULTS

AIC No. 168068-2 (Continued)
Sample Identification: Mod Water

Analyte	Method	Prep	Result	RL	Analyzed	Units	Batch	Qualifier
Sodium	EPA 200.7	Prep: 12-Jun-2013 1211 by 305	**26**	1	Analyzed: 12-Jun-2013 1608 by 305	**mg/l**	Batch: S34814	
Copper	EPA 200.8	Prep: 07-Jun-2013 1029 by 235	**< 1**	1	Analyzed: 07-Jun-2013 1514 by 305	**ug/l**	Batch: S34780	
Zinc	EPA 200.8	Prep: 07-Jun-2013 1029 by 235	**2.06**	2	Analyzed: 07-Jun-2013 1514 by 305	**ug/l**	Batch: S34780	
Chloride	EPA 300.0	Prep: 07-Jun-2013 1353 by 07	**2.0**	0.2	Analyzed: 07-Jun-2013 2052 by 302	**mg/l**	Batch: S34785	
Sulfate	EPA 300.0	Prep: 07-Jun-2013 1353 by 07	**85**	2	Analyzed: 07-Jun-2013 2000 by 302	**mg/l**	Batch: S34785	D Dil: 10
Dissolved Organic Carbon	SM 5310 C	Prep: 07-Jun-2013 1441 by 302	**< 1**	1	Analyzed: 08-Jun-2013 0135 by 302	**mg/l**	Batch: W43838	
Dissolved Copper	EPA 200.8	Prep: 07-Jun-2013 1029 by 235	**< 1**	1	Analyzed: 07-Jun-2013 1509 by 305	**ug/l**	Batch: S34780	
Dissolved Zinc	EPA 200.8	Prep: 07-Jun-2013 1029 by 235	**2.63**	2	Analyzed: 07-Jun-2013 1509 by 305	**ug/l**	Batch: S34780	

AIC No. 168068-3
Sample Identification: 12.5 ppb Cu C. dubia Initial Effluent

Analyte	Method	Prep	Result	RL	Analyzed	Units	Batch	Qualifier
Copper	EPA 200.8	Prep: 07-Jun-2013 1201 by 235	**16.1**	6	Analyzed: 07-Jun-2013 1226 by 305	**ug/l**	Batch: S34780	
Dissolved Copper	EPA 200.8	Prep: 07-Jun-2013 1201 by 235	**14.0**	6	Analyzed: 07-Jun-2013 1221 by 305	**ug/l**	Batch: S34780	

AIC No. 168068-4
Sample Identification: 100 ppb Cu C. dubia Initial Effluent

Analyte	Method	Prep	Result	RL	Analyzed	Units	Batch	Qualifier
Copper	EPA 200.8	Prep: 07-Jun-2013 1201 by 235	**106**	6	Analyzed: 07-Jun-2013 1237 by 305	**ug/l**	Batch: S34780	
Dissolved Copper	EPA 200.8	Prep: 07-Jun-2013 1201 by 235	**79.4**	6	Analyzed: 07-Jun-2013 1232 by 305	**ug/l**	Batch: S34780	

AIC No. 168068-5
Sample Identification: 6.25 ppb Cu C. dubia Initial Mod

Analyte	Method	Prep	Result	RL	Analyzed	Units	Batch	Qualifier
Copper	EPA 200.8	Prep: 07-Jun-2013 1201 by 235	**7.78**	1	Analyzed: 07-Jun-2013 1248 by 305	**ug/l**	Batch: S34780	
Dissolved Copper	EPA 200.8	Prep: 07-Jun-2013 1201 by 235	**6.92**	1	Analyzed: 07-Jun-2013 1243 by 305	**ug/l**	Batch: S34780	

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ANALYTICAL RESULTS

AIC No. 168068-6
Sample Identification: 50 ppb Cu C. dubia Initial Mod

Analyte		Result	RL	Units	Qualifier
Copper		**52.1**	6	**ug/l**	
EPA 200.8	Prep: 07-Jun-2013 1201 by 235	Analyzed: 07-Jun-2013 1259 by 305		Batch: S34780	
Dissolved Copper		**48.9**	6	**ug/l**	
EPA 200.8	Prep: 07-Jun-2013 1201 by 235	Analyzed: 07-Jun-2013 1253 by 305		Batch: S34780	

AIC No. 168068-7
Sample Identification: 37.5 ppb Zn C. dubia Initial Effluent

Analyte		Result	RL	Units	Qualifier
Zinc		**60.2**	2	**ug/l**	
EPA 200.8	Prep: 07-Jun-2013 1201 by 235	Analyzed: 07-Jun-2013 1309 by 305		Batch: S34780	
Dissolved Zinc		**58.1**	2	**ug/l**	
EPA 200.8	Prep: 07-Jun-2013 1201 by 235	Analyzed: 07-Jun-2013 1304 by 305		Batch: S34780	

AIC No. 168068-8
Sample Identification: 300 ppb Zn C. dubia Initial Effluent

Analyte		Result	RL	Units	Qualifier
Zinc		**341**	2	**ug/l**	
EPA 200.8	Prep: 07-Jun-2013 1201 by 235	Analyzed: 07-Jun-2013 1331 by 305		Batch: S34780	
Dissolved Zinc		**325**	2	**ug/l**	
EPA 200.8	Prep: 07-Jun-2013 1201 by 235	Analyzed: 07-Jun-2013 1326 by 305		Batch: S34780	

AIC No. 168068-9
Sample Identification: 18.8 ppb Zn C. dubia Initial Mod

Analyte		Result	RL	Units	Qualifier
Zinc		**21.3**	2	**ug/l**	
EPA 200.8	Prep: 07-Jun-2013 1201 by 235	Analyzed: 07-Jun-2013 1342 by 305		Batch: S34780	
Dissolved Zinc		**22.4**	2	**ug/l**	
EPA 200.8	Prep: 07-Jun-2013 1201 by 235	Analyzed: 07-Jun-2013 1336 by 305		Batch: S34780	

AIC No. 168068-10
Sample Identification: 150 ppb Zn C. dubia Initial Mod

Analyte		Result	RL	Units	Qualifier
Zinc		**150**	2	**ug/l**	
EPA 200.8	Prep: 07-Jun-2013 1201 by 235	Analyzed: 07-Jun-2013 1352 by 305		Batch: S34780	
Dissolved Zinc		**154**	2	**ug/l**	
EPA 200.8	Prep: 07-Jun-2013 1201 by 235	Analyzed: 07-Jun-2013 1347 by 305		Batch: S34780	

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ANALYTICAL RESULTS

AIC No. 168068-11
Sample Identification: 93.8 ppb Zn P.Promelas Initial Effluent

Analyte		Result	RL	Units	Qualifier
Zinc		**122**	2	**ug/l**	
EPA 200.8	Prep: 07-Jun-2013 1201 by 235	Analyzed: 07-Jun-2013 1403 by 305		Batch: S34780	
Dissolved Zinc		**117**	2	**ug/l**	
EPA 200.8	Prep: 07-Jun-2013 1201 by 235	Analyzed: 07-Jun-2013 1358 by 305		Batch: S34780	

AIC No. 168068-12
Sample Identification: 750 ppb Zn P.Promelas Initial Effluent

Analyte		Result	RL	Units	Qualifier
Zinc		**728**	2	**ug/l**	
EPA 200.7	Prep: 07-Jun-2013 1201 by 235	Analyzed: 07-Jun-2013 1431 by 305		Batch: S34780	
Dissolved Zinc		**742**	2	**ug/l**	
EPA 200.7	Prep: 07-Jun-2013 1201 by 235	Analyzed: 07-Jun-2013 1426 by 305		Batch: S34780	

AIC No. 168068-13
Sample Identification: 46.9 ppb Zn P.Promelas Initial Mod

Analyte		Result	RL	Units	Qualifier
Zinc		**49.1**	2	**ug/l**	
EPA 200.8	Prep: 07-Jun-2013 1201 by 235	Analyzed: 07-Jun-2013 1453 by 305		Batch: S34780	
Dissolved Zinc		**51.7**	2	**ug/l**	
EPA 200.8	Prep: 07-Jun-2013 1201 by 235	Analyzed: 07-Jun-2013 1447 by 305		Batch: S34780	

AIC No. 168068-14
Sample Identification: 750 ppb Zn P.Promelas Initial Mod

Analyte		Result	RL	Units	Qualifier
Zinc		**745**	2	**ug/l**	
EPA 200.8	Prep: 07-Jun-2013 1201 by 235	Analyzed: 07-Jun-2013 1503 by 305		Batch: S34780	
Dissolved Zinc		**741**	2	**ug/l**	
EPA 200.8	Prep: 07-Jun-2013 1201 by 235	Analyzed: 07-Jun-2013 1458 by 305		Batch: S34780	

AIC No. 168068-15
Sample Identification: 12.5 ppb Cu C. dubia Final Effluent

Analyte		Result	RL	Units	Qualifier
Copper		**14.9**	6	**ug/l**	
EPA 200.8	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1331 by 305		Batch: S34789	
Dissolved Copper		**12**	6	**ug/l**	
EPA 200.8	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1326 by 305		Batch: S34789	

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ANALYTICAL RESULTS

AIC No. 168068-16
Sample Identification: 100 ppb Cu C. dubia Final Effluent

Analyte		Result	RL	Units	Qualifier
Copper		**97.5**	6	**ug/l**	
EPA 200.8	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1342 by 305		Batch: S34789	
Dissolved Copper		**79.4**	6	**ug/l**	
EPA 200.8	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1337 by 305		Batch: S34789	

AIC No. 168068-17
Sample Identification: 6.25 ppb Cu C. dubia Final Mod

Analyte		Result	RL	Units	Qualifier
Copper		**6.77**	1	**ug/l**	
EPA 200.8	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1353 by 305		Batch: S34789	
Dissolved Copper		**5.78**	1	**ug/l**	
EPA 200.8	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1348 by 305		Batch: S34789	

AIC No. 168068-18
Sample Identification: 50 ppb Cu C. dubia Final Mod

Analyte		Result	RL	Units	Qualifier
Copper		**52.2**	6	**ug/l**	
EPA 200.8	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1414 by 305		Batch: S34789	
Dissolved Copper		**51.0**	6	**ug/l**	
EPA 200.8	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1358 by 305		Batch: S34789	

AIC No. 168068-19
Sample Identification: 37.5 ppb Zn C. dubia Final Effluent

Analyte		Result	RL	Units	Qualifier
Zinc		**49.4**	2	**ug/l**	
EPA 200.8	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1425 by 305		Batch: S34789	
Dissolved Zinc		**46.1**	2	**ug/l**	
EPA 200.8	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1420 by 305		Batch: S34789	

AIC No. 168068-20
Sample Identification: 300 ppb Zn C. dubia Final Effluent

Analyte		Result	RL	Units	Qualifier
Zinc		**281**	2	**ug/l**	
EPA 200.8	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1436 by 305		Batch: S34789	
Dissolved Zinc		**248**	2	**ug/l**	
EPA 200.8	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1431 by 305		Batch: S34789	

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ANALYTICAL RESULTS

AIC No. 168068-21
Sample Identification: 18.8 ppb Zn C. dubia Final Mod

Analyte		Result	RL	Units	Qualifier
Zinc		**30.4**	2	**ug/l**	
EPA 200.8	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1447 by 305		Batch: S34789	
Dissolved Zinc		**23.6**	2	**ug/l**	
EPA 200.8	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1441 by 305		Batch: S34789	

AIC No. 168068-22
Sample Identification: 150 ppb Zn C. dubia Final Mod

Analyte		Result	RL	Units	Qualifier
Zinc		**145**	2	**ug/l**	
EPA 200.8	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1457 by 305		Batch: S34789	
Dissolved Zinc		**153**	2	**ug/l**	
EPA 200.8	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1452 by 305		Batch: S34789	

AIC No. 168068-23
Sample Identification: 93.8 ppb Zn P.Promelas Final Effluent

Analyte		Result	RL	Units	Qualifier
Zinc		**107**	2	**ug/l**	
EPA 200.8	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1519 by 305		Batch: S34789	
Dissolved Zinc		**89.7**	2	**ug/l**	
EPA 200.8	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1503 by 305		Batch: S34789	

AIC No. 168068-24
Sample Identification: 750 ppb Zn P.Promelas Final Effluent

Analyte		Result	RL	Units	Qualifier
Zinc		**775**	2	**ug/l**	
EPA 200.7	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1530 by 305		Batch: S34789	
Dissolved Zinc		**773**	2	**ug/l**	
EPA 200.7	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1524 by 305		Batch: S34789	

AIC No. 168068-25
Sample Identification: 46.9 ppb Zn P.Promelas Final Mod

Analyte		Result	RL	Units	Qualifier
Zinc		**49.6**	2	**ug/l**	
EPA 200.8	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1540 by 305		Batch: S34789	
Dissolved Zinc		**52.7**	2	**ug/l**	
EPA 200.8	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1535 by 305		Batch: S34789	

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ANALYTICAL RESULTS

AIC No. 168068-26
Sample Identification: 750 ppb Zn P.Promelas Final Mod

Analyte		Result	RL	Units	Qualifier
Zinc		**704**	2	**ug/l**	
EPA 200.8	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1551 by 305		Batch: S34789	
Dissolved Zinc		720	2	**ug/l**	
EPA 200.8	Prep: 10-Jun-2013 1013 by 235	Analyzed: 10-Jun-2013 1546 by 305		Batch: S34789	

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DUPLICATE RESULTS

Analyte		AIC No.	Result	RPD	RPD Limit	Preparation Date	Analysis Date	Dil	Qual
Calcium		168068-1	22 mg/l			12Jun13 1211 by 305	12Jun13 1605 by 305		
	Batch: S34814	Duplicate	22 mg/l	0.0750	20.0	12Jun13 1212 by 305	12Jun13 1604 by 305		
Magnesium		168068-1	3.6 mg/l			12Jun13 1211 by 305	12Jun13 1605 by 305		
	Batch: S34814	Duplicate	3.5 mg/l	0.214	20.0	12Jun13 1212 by 305	12Jun13 1604 by 305		
Potassium		168068-1	4.5 mg/l			12Jun13 1211 by 305	12Jun13 1605 by 305		
	Batch: S34814	Duplicate	4.5 mg/l	0.133	20.0	12Jun13 1212 by 305	12Jun13 1604 by 305		
Sodium		168068-1	19 mg/l			12Jun13 1211 by 305	12Jun13 1605 by 305		
	Batch: S34814	Duplicate	19 mg/l	0.0718	20.0	12Jun13 1212 by 305	12Jun13 1604 by 305		
Alkalinity as CaCO3		168007-1	230 mg/l				07Jun13 0918 by 93		
	Batch: W43834	Duplicate	240 mg/l	2.58	20.0		07Jun13 0922 by 93		

LABORATORY CONTROL SAMPLE RESULTS

Analyte	Spike Amount	%	Limits	RPD	Limit	Batch	Preparation Date	Analysis Date	Dil	Qual
Total Organic Carbon	10 mg/l	92.7	80.0-120			W43838	07Jun13 1440 by 302	07Jun13 1800 by 302		
Calcium	10 mg/l	101	85.0-115			S34814	12Jun13 1212 by 305	12Jun13 1558 by 305		
	10 mg/l	106	85.0-115	4.25	20.0	S34814	12Jun13 1212 by 305	12Jun13 1601 by 305		
Magnesium	10 mg/l	104	85.0-115			S34814	12Jun13 1212 by 305	12Jun13 1558 by 305		
	10 mg/l	104	85.0-115	0.0497	20.0	S34814	12Jun13 1212 by 305	12Jun13 1601 by 305		
Potassium	10 mg/l	105	85.0-115			S34814	12Jun13 1212 by 305	12Jun13 1558 by 305		
	10 mg/l	105	85.0-115	0.110	20.0	S34814	12Jun13 1212 by 305	12Jun13 1601 by 305		
Sodium	10 mg/l	106	85.0-115			S34814	12Jun13 1212 by 305	12Jun13 1558 by 305		
	10 mg/l	106	85.0-115	0.569	20.0	S34814	12Jun13 1212 by 305	12Jun13 1601 by 305		
Calcium	5 mg/l	97.1	85.0-115			S34780	07Jun13 1029 by 235	07Jun13 1106 by 305		
	5 mg/l	99.2	85.0-115	2.19	20.0	S34780	07Jun13 1029 by 235	07Jun13 1112 by 305		
Copper	0.05 mg/l	102	85.0-115			S34780	07Jun13 1029 by 235	07Jun13 1106 by 305		
	0.05 mg/l	106	85.0-115	3.95	20.0	S34780	07Jun13 1029 by 235	07Jun13 1112 by 305		
Copper	0.05 mg/l	96.3	85.0-115			S34789	10Jun13 1013 by 235	10Jun13 1315 by 305		
	0.05 mg/l	98.8	85.0-115	2.53	20.0	S34789	10Jun13 1013 by 235	10Jun13 1321 by 305		
Magnesium	5 mg/l	106	85.0-115			S34780	07Jun13 1029 by 235	07Jun13 1106 by 305		
	5 mg/l	109	85.0-115	2.73	20.0	S34780	07Jun13 1029 by 235	07Jun13 1112 by 305		
Potassium	5 mg/l	110	85.0-115			S34780	07Jun13 1029 by 235	07Jun13 1106 by 305		
	5 mg/l	112	85.0-115	1.90	20.0	S34780	07Jun13 1029 by 235	07Jun13 1112 by 305		
Sodium	5 mg/l	108	85.0-115			S34780	07Jun13 1029 by 235	07Jun13 1106 by 305		
	5 mg/l	111	85.0-115	2.84	20.0	S34780	07Jun13 1029 by 235	07Jun13 1112 by 305		
Zinc	0.05 mg/l	105	85.0-115			S34780	07Jun13 1029 by 235	07Jun13 1106 by 305		
	0.05 mg/l	108	85.0-115	2.16	20.0	S34780	07Jun13 1029 by 235	07Jun13 1112 by 305		
Zinc	0.05 mg/l	93.4	85.0-115			S34789	10Jun13 1013 by 235	10Jun13 1315 by 305		
	0.05 mg/l	96.7	85.0-115	3.50	20.0	S34789	10Jun13 1013 by 235	10Jun13 1321 by 305		
Chloride	20 mg/l	98.0	90.0-110			S34785	07Jun13 1352 by 07	07Jun13 1450 by 302		
Sulfate	20 mg/l	97.4	90.0-110			S34785	07Jun13 1352 by 07	07Jun13 1450 by 302		

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MATRIX SPIKE SAMPLE RESULTS

Analyte	Sample	Spike Amount	%	Limits	Batch	Preparation Date	Analysis Date	Dil	Qual
Total Organic Carbon	168090-1	10 mg/l	90.2	80.0-120	W43838	07Jun13 1440 by 302	07Jun13 1840 by 302		
	168090-1	10 mg/l	91.2	80.0-120	W43838	07Jun13 1440 by 302	07Jun13 1900 by 302		
	Relative Percent Difference:		0.667	25.0	W43838				
Chloride	168091-1	20 mg/l	97.9	80.0-120	S34785	07Jun13 1352 by 07	07Jun13 1516 by 302		
	168091-1	20 mg/l	98.5	80.0-120	S34785	07Jun13 1352 by 07	07Jun13 1542 by 302		
	Relative Percent Difference:		0.598	10.0	S34785				
Sulfate	168091-1	20 mg/l	96.3	80.0-120	S34785	07Jun13 1352 by 07	07Jun13 1516 by 302		
	168091-1	20 mg/l	97.4	80.0-120	S34785	07Jun13 1352 by 07	07Jun13 1542 by 302		
	Relative Percent Difference:		1.09	10.0	S34785				

LABORATORY BLANK RESULTS

Analyte	Result	RL	PQL	QC Sample	Preparation Date	Analysis Date	Qual
Alkalinity as CaCO3	< 1 mg/l	1	1	W43834-3		07Jun13 0922 by 93	
Total Organic Carbon	< 1 mg/l	1	1	W43838-1	07Jun13 1440 by 302	07Jun13 1740 by 302	
Calcium	< 0.1 mg/l	0.1	0.1	S34814-1	12Jun13 1212 by 305	12Jun13 1556 by 305	
Magnesium	< 0.03 mg/l	0.03	0.03	S34814-1	12Jun13 1212 by 305	12Jun13 1556 by 305	
Potassium	< 1 mg/l	1	1	S34814-1	12Jun13 1212 by 305	12Jun13 1556 by 305	
Sodium	< 1 mg/l	1	1	S34814-1	12Jun13 1212 by 305	12Jun13 1556 by 305	
Copper	< 0.006 mg/l	0.006	0.006	S34780-1	07Jun13 1029 by 235	07Jun13 1101 by 305	
Copper	< 0.001 mg/l	0.001	0.001	S34780-1	07Jun13 1029 by 235	07Jun13 1101 by 305	
Zinc	< 0.002 mg/l	0.002	0.002	S34780-1	07Jun13 1029 by 235	07Jun13 1101 by 305	
Copper	< 6 ug/l	6	6	S34789-1	10Jun13 1013 by 235	10Jun13 1310 by 305	
Copper	< 1 ug/l	1	1	S34789-1	10Jun13 1013 by 235	10Jun13 1310 by 305	
Zinc	< 2 ug/l	2	2	S34789-1	10Jun13 1013 by 235	10Jun13 1310 by 305	
Chloride	< 0.2 mg/l	0.2	0.2	S34785-1	07Jun13 1352 by 07	07Jun13 1424 by 302	
Sulfate	< 0.2 mg/l	0.2	0.2	S34785-1	07Jun13 1352 by 07	07Jun13 1424 by 302	

AMERICAN INTERPLEX CORPORATION
LABORATORIES

CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

PAGE ___ OF ___

Client: VAN BUREN MUNICIPAL UTILITIES
Project Reference: NORTH PLANT
Project Manager:
Sampled By: [illegible]
PO No.:

AIC CONTROL NO: 168015
AIC PROPOSAL NO:
Carrier: Fed-X
Received Temperature C: 2

AIC No.	Sample Identification	Date/Time Collected	GRAB	COMP	WATER	SOIL		NO OF BOTTLES	WER												Remarks
	NPEO1	6/3-4/13 9:30-9:30AM		X	X			6	X												pH 6.56
																					Field pH calibration
		Container Type						P													on ______ @ ______
		Preservative						NO													Buffer:

G = Glass NO = none P = Plastic S = Sulfuric acid pH2 V = VOA vials N = Nitric acid pH2 H = HCl to pH2 B = NaOH to pH12 T = Sodium Thiosulfate Z = Zinc acetate

Turnaround Time Requested: (Please circle)
NORMAL or EXPEDITED IN ____ DAYS
Expedited results requested by: ____________
Who should AIC contact with questions: ____________
Phone: 479-719-6508 Fax: ____________
Report Attention to: VBFred@aol.com
Report Address to:

Relinquished By:	Date/Time	Received By:	Date/Time
[illegible]	6/4/13 11:11	FED EX - @ 029865615001294	6/4/13 11:11
Relinquished By:	Date/Time	Received in Lab By:	Date/Time
		[illegible]	6-5-13 1130

Comments: PER PAT DOWNEY, FTN ASSOC. 9612019 0298 656 15001294

5/01 WS 5981 8/02 FORM 0060

August 16, 2013

Test Results of Acute 48 hour Non-Renewal Biomonitoring Testing for

169529-1: Effluent Copper Spiked
169529-2: Moderately Hard Water Copper spiked

Prepared for:

Mr. Pat Downey
FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Prepared by:

AMERICAN INTERPLEX CORPORATION
8600 Kanis Road
Little Rock, AR 72204-2322

AMERICAN INTERPLEX CORPORATION LABORATORIES

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Re: Acute 48 hour Non-Renewal Biomonitoring utilizing *Ceriodaphnia dubia*
Effluent Copper Spiked

Dear Mr. Pat Downey:

Please find enclosed the toxicity data for the Copper Water Effects Ratio study.

If I can be of further assistance, please feel free to contact me.

AMERICAN INTERPLEX CORPORATION

John Overbey
Laboratory Director

PDF cc: FTN Associates, Ltd.
ATTN: Mr. Pat Downey
pjd@ftn-assoc.com

Dilution Water Samples: North Plan Effluent

Analysis	Result
Dissolved oxygen (mg/l)	8.6
pH (standard units)	8.1
Alkalinity (mg/l as CaCO3)	64
Hardness (mg/l as CaCO3)	64
Conductivity (umhos/cm)	330
Residual Chlorine (mg/l)	NA

Results Summary: Effluent Copper Spiked

Ceriodaphnia dubia

The *Ceriodaphnia dubia* test was conducted from August 8, 2013 at 1520 to August 10, 2013 at 1715.

Statistical analyses:

NOEC = 90ppb
LC50 = 102.3ppb

Concentration	24 hour % Survival	48 hour % Survival
Control	100	100
19.4ppb	100	100
32.4ppb	100	100
54.0ppb	100	100
90.0ppb	80.0	75.0
150ppb	0.00	0.00 *
250ppb	0.00	0.00 *

*Significant difference compared to the control (p=0.05)

Ceriodaphnia dubia
Survival Data

Number of organisms per chamber: 5
Volume of test chamber: 30 ml

Age of organisms: <24 hours
Volume of test solution: 15 ml

Effluent Concentration		Number of Survivors 24 Hours	48 Hours	% Survival	CV %
Control	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
19.4ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
32.4ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
54.0ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
90.0ppb	rep. A	5	5	75.0	50.5
	rep. B	2	1		
	rep. C	4	4		
	rep. D	5	5		
150ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		
250ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		

CV = Coefficient of variance = standard deviation X 100/mean

Ceriodaphnia dubia

Transformation of Data — Transform: Arc Sin(Square Root(Y))

Group	Identification	Rep	Value	Transformed
1	Control	1	1.00000	1.34530
1	Control	2	1.00000	1.34530
1	Control	3	1.00000	1.34530
1	Control	4	1.00000	1.34530
2	19.4ppb	1	1.00000	1.34530
2	19.4ppb	2	1.00000	1.34530
2	19.4ppb	3	1.00000	1.34530
2	19.4ppb	4	1.00000	1.34530
3	32.4ppb	1	1.00000	1.34530
3	32.4ppb	2	1.00000	1.34530
3	32.4ppb	3	1.00000	1.34530
3	32.4ppb	4	1.00000	1.34530
4	54ppb	1	1.00000	1.34530
4	54ppb	2	1.00000	1.34530
4	54ppb	3	1.00000	1.34530
4	54ppb	4	1.00000	1.34530
5	90ppb	1	1.00000	1.34530
5	90ppb	2	0.20000	0.46365
5	90ppb	3	0.80000	1.10710
5	90ppb	4	1.00000	1.34530
6	150ppb	1	0.00000	0.22551
6	150ppb	2	0.00000	0.22551
6	150ppb	3	0.00000	0.22551
6	150ppb	4	0.00000	0.22551
7	250ppb	1	0.00000	0.22551
7	250ppb	2	0.00000	0.22551
7	250ppb	3	0.00000	0.22551
7	250ppb	4	0.00000	0.22551

Ceriodaphnia dubia

Shapiro - Wilk's Test for Normality	Transform: Arc Sin(Square Root(Y))
D = 0.5205	
W = 0.435	
Critical W = 0.896	(alpha = 0.01, N = 28)
Critical W = 0.924	(alpha = 0.05, N = 28)

Data FAIL normality test (alpha = 0.01).

Steel's Many-One Rank Test — Transform: Arc Sin(Square Root(Y))

Ho:Control<Treatment

Group	Identification	Rank Sum	Critical Value	DF	Sig 0.05
1	Control				
2	19.4ppb	18.00	10.00	4.00	
3	32.4ppb	18.00	10.00	4.00	
4	54ppb	18.00	10.00	4.00	
5	90ppb	14.00	10.00	4.00	
6	150ppb	10.00	10.00	4.00	*
7	250ppb	10.00	10.00	4.00	*

Critical values are 1 tailed (k=6)

Ceriodaphnia dubia

Spearman-Karber Method for Calculating LC50 Values

Concentration	Number Exposed	Number Responding	Proportion Responding	Smoothed Proportion	Smoothed Adjusted Proportion
Control	20	0	0	0	0
19.4	20	0	0	0	0
32.4	20	0	0	0	0
54	20	0	0	0	0
90	20	5	0.25	0.25	0.25
150	20	20	1	1	1
250	20	20	1	1	1

LC50 = 102.3
Upper Confidence Limit = 113.2
Lower Confidence Limit = 92.39

Variance = 0.0004857

Chemical Data for
Ceriodaphnia dubia

Day 1		Control	19.4ppb	32.4ppb	54.0ppb	90.0ppb	150ppb	250ppb
DO, mg/l	Initial	8.6	7.9	8.0	8.0	8.0	8.0	8.0
DO, mg/l	Final	7.7	8.0	8.0	8.0	8.0	8.0	8.0
pH, su	Initial	8.1	8.5	8.5	8.5	8.5	8.5	8.4
pH, su	Final	8.6	8.6	8.6	7.9	7.9	7.6	7.7
Alkalinity, mg/l		64	NA	NA	NA	NA	NA	NA
Hardness, mg/l		64	NA	NA	NA	NA	NA	NA
Conductivity, umho/cm		330	350	360	360	360	360	360

Day 2		Control	19.4ppb	32.4ppb	54.0ppb	90.0ppb	150ppb	250ppb
DO, mg/l	Final	8.6	8.6	8.7	8.7	8.6	7.9	8.6
pH, su	Final	7.8	8.1	8.3	8.1	8.1	8.1	8.1

AMERICAN INTERPLEX CORPORATION LABORATORIES

CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

Client: VAN BUREN MUNICIPAL UTILITIES

Project Reference: NORTH PLANT

Project Manager: CLYDE Hill

Sampled By: [illegible]

PO No.:

AIC CONTROL NO: 169529

AIC PROPOSAL NO:

Carrier: fed x

Received Temperature C: 2.1

AIC No.	Sample Identification	Date/Time Collected	GRAB	COMP	SAMPLE MATRIX: WATER	SAMPLE MATRIX: SOIL		NO OF BOTTLES	ANALYSES REQUESTED: WER STUDY												Remarks
	NPE1	8/5-6/13 11:00-11:00AM		X	X			3	X												7.08/
																					Field pH calibration
		Container Type						P													on 8/6 @ 9:30
		Preservative						NO													Buffer: 4-7-10

G = Glass; NO = none; P = Plastic; S = Sulfuric acid pH2; V = VOA vials; N = Nitric acid pH2; H = HCl to pH2; B = NaOH to pH12; T = Sodium Thiosulfate; Z = Zinc acetate

Turnaround Time Requested: (Please circle)
NORMAL or EXPEDITED IN ____ DAYS
Expedited results requested by:
Who should AIC contact with questions: CLYDE Hill / FTN
Phone: ________ Fax:
Report Attention to: FTN
Report Address to:

Relinquished By	Date/Time	Received By	Date/Time
[illegible]	8/6/13 11:33	FEDEX-G 029865615001447	8/6/13 11:33
Relinquished By:	Date/Time	Received in Lab By: [illegible]	8-7-13 11:30

Comments:

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Re: Acute 48 hour Non-Renewal Biomonitoring utilizing *Ceriodaphnia dubia*
Moderately Hard Water Copper spiked

Dilution Water Samples: Synthetic Moderately Hard Water #4010

Analysis	Result
Dissolved oxygen (mg/l)	8.0
pH (standard units)	8.5
Alkalinity (mg/l as CaCO3)	58
Hardness (mg/l as CaCO3)	89
Conductivity (umhos/cm)	310
Residual Chlorine (mg/l)	<0.05

Results Summary: Moderately Hard Water Copper spiked
Ceriodaphnia dubia

The *Ceriodaphnia dubia* test was conducted from August 8, 2013 at 1500 to August 10, 2013 at 1700.
Statistical analyses:
NOEC = 10.8ppb
LC50 = 13.9ppb

Concentration	24 hour % Survival	48 hour % Survival
Control	100	100
3.89ppb	100	100
6.48ppb	100	100
10.8ppb	100	100
18.0ppb	0.00	0.00 *
30.0ppb	0.00	0.00 *
50.0ppb	0.00	0.00 *

*Significant difference compared to the control (p=0.05)

Ceriodaphnia dubia
Survival Data

Number of organisms per chamber: 5
Volume of test chamber: 30 ml
Age of organisms: <24 hours
Volume of test solution: 15 ml

Effluent Concentration		Number of Survivors 24 Hours	48 Hours	% Survival	CV %
Control	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
3.89ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
6.48ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
10.8ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
18.0ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		
30.0ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		
50.0ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		

CV = Coefficient of variance = standard deviation X 100/mean

Ceriodaphnia dubia

		Transformation of Data	Transform: Arc Sin(Square Root(Y))	
Group	Identification	Rep	Value	Transformed
1	Control	1	1.00000	1.34530
1	Control	2	1.00000	1.34530
1	Control	3	1.00000	1.34530
1	Control	4	1.00000	1.34530
2	3.89ppb	1	1.00000	1.34530
2	3.89ppb	2	1.00000	1.34530
2	3.89ppb	3	1.00000	1.34530
2	3.89ppb	4	1.00000	1.34530
3	6.48ppb	1	1.00000	1.34530
3	6.48ppb	2	1.00000	1.34530
3	6.48ppb	3	1.00000	1.34530
3	6.48ppb	4	1.00000	1.34530
4	10.8ppb	1	1.00000	1.34530
4	10.8ppb	2	1.00000	1.34530
4	10.8ppb	3	1.00000	1.34530
4	10.8ppb	4	1.00000	1.34530
5	18ppb	1	0.00000	0.22551
5	18ppb	2	0.00000	0.22551
5	18ppb	3	0.00000	0.22551
5	18ppb	4	0.00000	0.22551
6	30ppb	1	0.00000	0.22551
6	30ppb	2	0.00000	0.22551
6	30ppb	3	0.00000	0.22551
6	30ppb	4	0.00000	0.22551
7	50ppb	1	0.00000	0.22551
7	50ppb	2	0.00000	0.22551
7	50ppb	3	0.00000	0.22551
7	50ppb	4	0.00000	0.22551

Ceriodaphnia dubia

Shapiro - Wilk's Test for Normality	Transform: Arc Sin(Square Root(Y))
D = 0	
W = 0	
Critical W = 0.896	(alpha = 0.01, N = 28)
Critical W = 0.924	(alpha = 0.05, N = 28)

Data FAIL normality test (alpha = 0.01).

Steel's Many-One Rank Test — Transform: Arc Sin(Square Root(Y))

Ho:Control<Treatment

Group	Identification	Rank Sum	Critical Value	DF	Sig 0.05
1	Control				
2	3.89ppb	18.00	10.00	4.00	
3	6.48ppb	18.00	10.00	4.00	
4	10.8ppb	18.00	10.00	4.00	
5	18ppb	10.00	10.00	4.00	*
6	30ppb	10.00	10.00	4.00	*
7	50ppb	10.00	10.00	4.00	*

Critical values are 1 tailed (k=6)

Ceriodaphnia dubia

Graphical LC50 Method

Concentration	Number Exposed	Number Responding	Proportion Responding	Smoothed Proportion	Smoothed Adjusted Proportion
Control	20	0	0	0	0
3.89	20	0	0	0	0
6.48	20	0	0	0	0
10.8	20	0	0	0	0
18	20	20	1	1	1
30	20	20	1	1	1
50	20	20	1	1	1

LC50 = 13.9

Chemical Data for
Ceriodaphnia dubia

Day 1		Control	3.89ppb	6.48ppb	10.8ppb	18.0ppb	30.0ppb	50.0ppb
DO, mg/l	Initial	8.0	8.1	8.1	8.1	8.1	8.1	8.1
DO, mg/l	Final	8.0	8.1	8.1	8.2	8.1	8.1	8.1
pH, su	Initial	8.5	8.4	8.5	8.4	8.4	8.4	8.4
pH, su	Final	7.7	7.6	8.7	8.6	8.5	8.6	8.6
Alkalinity, mg/l		58	NA	NA	NA	NA	NA	NA
Hardness, mg/l		89	NA	NA	NA	NA	NA	NA
Conductivity, umho/cm		310	320	320	320	320	320	320
Residual Chlorine, mg/l		<0.05	NA	NA	NA	NA	NA	NA

Day 2		Control	3.89ppb	6.48ppb	10.8ppb	18.0ppb	30.0ppb	50.0ppb
DO, mg/l	Final	7.9	7.8	8.2	8.0	8.2	8.0	8.2
pH, su	Final	8.1	8.1	8.1	8.2	8.2	8.2	8.2

AMERICAN INTERPLEX CORPORATION LABORATORIES

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

This report contains the analytical results and supporting information for samples submitted on August 7, 2013. Attached please find a copy of the Chain of Custody and/or other documents received. Note that any remaining sample will be discarded two weeks from the original report date unless other arrangements are made.

This report is intended for the sole use of the client listed above. Assessment of the data requires access to the entire document.

This report has been reviewed by the Laboratory Director or a qualified designee.

John Overbey
Laboratory Director

This document has been distributed to the following:

PDF cc: FTN Associates, Ltd.
ATTN: Mr. Pat Downey
pjd@ftn-assoc.com

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

SAMPLE INFORMATION

Project Description:
One (1) water sample(s) received on August 7, 2013
North Plant

Receipt Details:
A Chain of Custody was provided. The samples were delivered in one (1) ice chest.
Ice chest #1 was delivered with shipping documentation.

Each sample container was checked for proper labeling, including date and time sampled. Sample containers were reviewed for proper type, adequate volume, integrity, temperature, preservation, and holding times. Any exceptions are noted below:

Sample Identification:

Laboratory ID	Client Sample ID	Sampled Date/Time	Notes
169545-1	NPE1 8/5-6/13 11:00-11:00am	06-Aug-2013 1100	
169545-2	Mod Water		
169545-3	Effluent Initial 250 ppb Cu		
169545-4	Effluent Initial 150 ppb Cu		
169545-5	Effluent Initial 90 ppb Cu		
169545-6	Effluent Initial 54 ppb Cu		
169545-7	Effluent Initial 32.4 ppb Cu		
169545-8	Effluent Initial 19.4 ppb Cu		
169545-9	Effluent Initial Control Cu		
169545-10	Moderately Hard Water Initial 50 ppb Cu		
169545-11	Moderately Hard Water Initial 30 ppb Cu		
169545-12	Moderately Hard Water Initial 18 ppb Cu		
169545-13	Moderately Hard Water Initial 10.8 ppb Cu		
169545-14	Moderately Hard Water Initial 6.48 ppb Cu		
169545-15	Moderately Hard Water Initial 3.89 ppb Cu		
169545-16	Moderately Hard Water Initial Control Cu		
169545-17	Effluent Final 250 ppb Cu		
169545-18	Effluent Final 150 ppb Cu		
169545-19	Effluent Final 90 ppb Cu		
169545-20	Effluent Final 54 ppb Cu		
169545-21	Effluent Final 32.4 ppb Cu		
169545-22	Effluent Final 19.4 ppb Cu		
169545-23	Effluent Final Control Cu		
169545-24	Moderately Hard Water Final 50 ppb Cu		
169545-25	Moderately Hard Water Final 30 ppb Cu		
169545-26	Moderately Hard Water Final 18 ppb Cu		
169545-27	Moderately Hard Water Final 10.8 ppb Cu		
169545-28	Moderately Hard Water Final 6.48 ppb Cu		
169545-29	Moderately Hard Water Final 3.89 ppb Cu		
169545-30	Moderately Hard Water Final Control Cu		

Qualifiers:

D Result is from a secondary dilution factor
H Analytical holding time exceeded regulatory requirements
X Spiking level is invalid due to the high concentration of analyte in the spiked sample

AMERICAN INTERPLEX CORPORATION LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

SAMPLE INFORMATION

Case Narrative:
Analytical results on sample NPE1 were performed from the unpreserved composite sample submitted for WER testing.

Table II of 40 CFR Part 136.3 indicates analysis of pH, Total Residual Chlorine, and Dissolved Oxygen are to be performed on site or immediately after collection. American Interplex Corporation analyzes these parameters as soon as possible after laboratory receipt.

References:
"Methods for Chemical Analysis of Water and Wastes", EPA/600/4-79-020 (Mar 1983) with updates and supplements EPA/600/5-91-010 (Jun 1991), EPA/600/R-92-129 (Aug 1992) and EPA/600/R-93-100 (Aug 1993).
"Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846)", Third Edition.
"Standard Methods for the Examination of Water and Wastewaters", 21st edition.
"American Society for Testing and Materials" (ASTM).
"Association of Analytical Chemists" (AOAC).

AMERICAN INTERPLEX CORPORATION LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 169545-1
Sample Identification: NPE1 8/5-6/13 11:00-11:00am

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3 SM 2320 B		**64** Analyzed: 09-Aug-2013 0910 by 93	1	**mg/l** Batch: W44485	
pH SM 4500-H+ B		**7.5** Analyzed: 07-Aug-2013 1521 by 93		**Units** Batch: W44455	H
Ammonia as N SM 4500-NH3 G	Prep: 07-Aug-2013 1525 by 308	**0.17** Analyzed: 08-Aug-2013 0846 by 308	0.1	**mg/l** Batch: W44446	
Carbonaceous BOD 5-day SM 5210 B	Prep: 08-Aug-2013 0805 by 285	**< 2** Analyzed: 13-Aug-2013 0942 by 285	2	**mg/l** Batch: W44465	
Total Organic Carbon SM 5310 C	Prep: 08-Aug-2013 1424 by 308	**6.9** Analyzed: 08-Aug-2013 1804 by 308	1	**mg/l** Batch: W44474	
Total Suspended Solids USGS 3765	Prep: 08-Aug-2013 0949 by 308	**< 4** Analyzed: 08-Aug-2013 1533 by 308	4	**mg/l** Batch: W44467	
Sodium EPA 200.7	Prep: 08-Aug-2013 1200 by 305	**35.9** Analyzed: 09-Aug-2013 1106 by 305	10	**mg/l** Batch: S35174	D Dil: 10
Potassium EPA 200.8	Prep: 08-Aug-2013 1200 by 305	**9.81** Analyzed: 08-Aug-2013 1458 by 305	1	**mg/l** Batch: S35174	
Chloride EPA 300.0	Prep: 07-Aug-2013 1504 by 302	**36** Analyzed: 07-Aug-2013 2240 by 302	0.2	**mg/l** Batch: S35157	
Sulfate EPA 300.0	Prep: 07-Aug-2013 1504 by 302	**22** Analyzed: 07-Aug-2013 2240 by 302	0.2	**mg/l** Batch: S35157	
Hardness as CaCO3 SM 2340 B	Prep: 08-Aug-2013 1200 by 305	**64** Analyzed: 08-Aug-2013 1458 by 305	1	**mg/l** Batch: S35174	
Dissolved Organic Carbon SM 5310 C	Prep: 08-Aug-2013 1425 by 308	**5.2** Analyzed: 08-Aug-2013 1833 by 308	1	**mg/l** Batch: W44474	
Dissolved Copper EPA 200.8	Prep: 08-Aug-2013 1200 by 305	**3.50** Analyzed: 08-Aug-2013 1453 by 305	1	**ug/l** Batch: S35174	
Dissolved Zinc EPA 200.8	Prep: 08-Aug-2013 1200 by 305	**89.2** Analyzed: 08-Aug-2013 1453 by 305	2	**ug/l** Batch: S35174	
Total Recoverable Copper EPA 200.8	Prep: 08-Aug-2013 1200 by 305	**4.09** Analyzed: 08-Aug-2013 1458 by 305	1	**ug/l** Batch: S35174	
Total Recoverable Zinc EPA 200.8	Prep: 08-Aug-2013 1200 by 305	**89.9** Analyzed: 08-Aug-2013 1458 by 305	2	**ug/l** Batch: S35174	

AIC No. 169545-2
Sample Identification: Mod Water

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3 SM 2320 B		**58** Analyzed: 09-Aug-2013 0910 by 93	1	**mg/l** Batch: W44485	
Carbonaceous BOD 5-day SM 5210 B	Prep: 08-Aug-2013 1528 by 285	**< 2** Analyzed: 13-Aug-2013 1005 by 285	2	**mg/l** Batch: W44465	

AMERICAN INTERPLEX CORPORATION LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 169545-2 (Continued)
Sample Identification: Mod Water

Analyte		Result	RL	Units	Qualifier
Total Organic Carbon		**< 1**	1	**mg/l**	
SM 5310 C	Prep: 08-Aug-2013 1424 by 308	Analyzed: 09-Aug-2013 1121 by 308		Batch: W44474	
Total Suspended Solids		**< 4**	4	**mg/l**	
USGS 3765	Prep: 09-Aug-2013 1024 by 308	Analyzed: 09-Aug-2013 1544 by 308		Batch: W44487	
Hardness as CaCO3		**89**	1	**mg/l**	
SM 2340 B	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1450 by 305		Batch: S35174	
Dissolved Organic Carbon		**< 1**	1	**mg/l**	
SM 5310 C	Prep: 08-Aug-2013 1425 by 308	Analyzed: 09-Aug-2013 1135 by 308		Batch: W44474	
Dissolved Copper		**< 1**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1504 by 305		Batch: S35174	
Dissolved Zinc		**4.74**	2	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1504 by 305		Batch: S35174	
Total Recoverable Copper		**< 1**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1509 by 305		Batch: S35174	
Total Recoverable Zinc		**8.24**	2	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1509 by 305		Batch: S35174	

AIC No. 169545-3
Sample Identification: Effluent Initial 250 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**229**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1520 by 305		Batch: S35174	
Dissolved Copper		**197**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1514 by 305		Batch: S35174	

AIC No. 169545-4
Sample Identification: Effluent Initial 150 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**136**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1725 by 305		Batch: S35174	
Dissolved Copper		**113**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1720 by 305		Batch: S35174	

AIC No. 169545-5
Sample Identification: Effluent Initial 90 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**86.4**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1736 by 305		Batch: S35174	
Dissolved Copper		**67.4**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1731 by 305		Batch: S35174	

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ANALYTICAL RESULTS

AIC No. 169545-6
Sample Identification: Effluent Initial 54 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**52.1**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1747 by 305		Batch: S35174	
Dissolved Copper		**43.7**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1742 by 305		Batch: S35174	

AIC No. 169545-7
Sample Identification: Effluent Initial 32.4 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**34.3**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1758 by 305		Batch: S35174	
Dissolved Copper		**27.9**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1752 by 305		Batch: S35174	

AIC No. 169545-8
Sample Identification: Effluent Initial 19.4 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**23.6**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1808 by 305		Batch: S35174	
Dissolved Copper		**18.2**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1803 by 305		Batch: S35174	

AIC No. 169545-9
Sample Identification: Effluent Initial Control Cu

Analyte		Result	RL	Units	Qualifier
Copper		**4.09**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1458 by 305		Batch: S35174	
Dissolved Copper		**3.50**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1453 by 305		Batch: S35174	

AIC No. 169545-10
Sample Identification: Moderately Hard Water Initial 50 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**47.2**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1530 by 305		Batch: S35174	
Dissolved Copper		**43.9**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1525 by 305		Batch: S35174	

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ANALYTICAL RESULTS

AIC No. 169545-11
Sample Identification: Moderately Hard Water Initial 30 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**27.3**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1830 by 305		Batch: S35174	
Dissolved Copper		**23.8**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1825 by 305		Batch: S35174	

AIC No. 169545-12
Sample Identification: Moderately Hard Water Initial 18 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**16.8**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1841 by 305		Batch: S35174	
Dissolved Copper		**16.2**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1835 by 305		Batch: S35174	

AIC No. 169545-13
Sample Identification: Moderately Hard Water Initial 10.8 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**13.0**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1852 by 305		Batch: S35174	
Dissolved Copper		**10.7**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1846 by 305		Batch: S35174	

AIC No. 169545-14
Sample Identification: Moderately Hard Water Initial 6.48 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**6.99**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1902 by 305		Batch: S35174	
Dissolved Copper		**6.03**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1857 by 305		Batch: S35174	

AIC No. 169545-15
Sample Identification: Moderately Hard Water Initial 3.89 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**4.87**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1913 by 305		Batch: S35174	
Dissolved Copper		**4.23**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1908 by 305		Batch: S35174	

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ANALYTICAL RESULTS

AIC No. 169545-16
Sample Identification: Moderately Hard Water Initial Control Cu

Analyte		Result	RL	Units	Qualifier
Copper		**< 1**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1509 by 305		Batch: S35174	
Dissolved Copper		**< 1**	1	**ug/l**	
EPA 200.8	Prep: 08-Aug-2013 1200 by 305	Analyzed: 08-Aug-2013 1504 by 305		Batch: S35174	

AIC No. 169545-17
Sample Identification: Effluent Final 250 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**221**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1540 by 305		Batch: S35194	
Dissolved Copper		**177**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1535 by 305		Batch: S35194	

AIC No. 169545-18
Sample Identification: Effluent Final 150 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**127**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1602 by 305		Batch: S35194	
Dissolved Copper		**110**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1556 by 305		Batch: S35194	

AIC No. 169545-19
Sample Identification: Effluent Final 90 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**75.8**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1623 by 305		Batch: S35194	
Dissolved Copper		**66.8**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1618 by 305		Batch: S35194	

AIC No. 169545-20
Sample Identification: Effluent Final 54 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**49.6**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1636 by 305		Batch: S35194	
Dissolved Copper		**38.1**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1630 by 305		Batch: S35194	

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ANALYTICAL RESULTS

AIC No. 169545-21
Sample Identification: Effluent Final 32.4 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**31.5**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1646 by 305		Batch: S35194	
Dissolved Copper		**27.6**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1641 by 305		Batch: S35194	

AIC No. 169545-22
Sample Identification: Effluent Final 19.4 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**21.2**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1657 by 305		Batch: S35194	
Dissolved Copper		**15.6**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1652 by 305		Batch: S35194	

AIC No. 169545-23
Sample Identification: Effluent Final Control Cu

Analyte		Result	RL	Units	Qualifier
Copper		**4.39**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1518 by 305		Batch: S35194	
Dissolved Copper		**3.71**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1513 by 305		Batch: S35194	

AIC No. 169545-24
Sample Identification: Moderately Hard Water Final 50 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**43.6**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1551 by 305		Batch: S35194	
Dissolved Copper		**37.7**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1546 by 305		Batch: S35194	

AIC No. 169545-25
Sample Identification: Moderately Hard Water Final 30 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**27.7**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1708 by 305		Batch: S35194	
Dissolved Copper		**22.3**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1703 by 305		Batch: S35194	

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ANALYTICAL RESULTS

AIC No. 169545-26
Sample Identification: Moderately Hard Water Final 18 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**15.9**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1729 by 305		Batch: S35194	
Dissolved Copper		**12.7**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1724 by 305		Batch: S35194	

AIC No. 169545-27
Sample Identification: Moderately Hard Water Final 10.8 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**9.94**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1740 by 305		Batch: S35194	
Dissolved Copper		**7.27**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1735 by 305		Batch: S35194	

AIC No. 169545-28
Sample Identification: Moderately Hard Water Final 6.48 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**6.49**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1751 by 305		Batch: S35194	
Dissolved Copper		**4.31**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1746 by 305		Batch: S35194	

AIC No. 169545-29
Sample Identification: Moderately Hard Water Final 3.89 ppb Cu

Analyte		Result	RL	Units	Qualifier
Copper		**3.99**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1802 by 305		Batch: S35194	
Dissolved Copper		**3.00**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 12-Aug-2013 1756 by 305		Batch: S35194	

AIC No. 169545-30
Sample Identification: Moderately Hard Water Final Control Cu

Analyte		Result	RL	Units	Qualifier
Copper		**1.22**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 13-Aug-2013 1307 by 305		Batch: S35194	
Dissolved Copper		**1.12**	1	**ug/l**	
EPA 200.8	Prep: 12-Aug-2013 1430 by 305	Analyzed: 13-Aug-2013 1303 by 305		Batch: S35194	

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DUPLICATE RESULTS

Analyte		AIC No.	Result	RPD	RPD Limit	Preparation Date	Analysis Date	Dil	Qual
pH		169540-1	4.0 Units				07Aug13 1521 by 93		H
	Batch: W44455	Duplicate	4.0 Units	2.25	5.00		07Aug13 1521 by 93		H
Carbonaceous BOD 5-day		169533-1	< 2 mg/l			08Aug13 0805 by 285	13Aug13 0937 by 285		
	Batch: W44465	Duplicate	< 2 mg/l	0.00	20.0	08Aug13 0806 by 285	13Aug13 0939 by 285		
Total Suspended Solids		169536-1	8.0 mg/l			08Aug13 0949 by 308	08Aug13 1533 by 308		
	Batch: W44467	Duplicate	6.8 mg/l	16.2	20.0	08Aug13 0950 by 308	08Aug13 1533 by 308		
Total Suspended Solids		169535-1	46 mg/l			08Aug13 0949 by 308	08Aug13 1533 by 308		
	Batch: W44467	Duplicate	46 mg/l	0.866	20.0	08Aug13 0950 by 308	08Aug13 1533 by 308		
Alkalinity as CaCO3		169601-1	240 mg/l				09Aug13 0910 by 93		
	Batch: W44485	Duplicate	240 mg/l	2.51	20.0		09Aug13 0910 by 93		
Total Suspended Solids		169577-1	5.6 mg/l			09Aug13 1024 by 308	09Aug13 1544 by 308		
	Batch: W44487	Duplicate	6.4 mg/l	13.3	20.0	09Aug13 1024 by 308	09Aug13 1544 by 308		
Total Suspended Solids		169559-3	< 4 mg/l			09Aug13 1024 by 308	09Aug13 1544 by 308		
	Batch: W44487	Duplicate	< 4 mg/l	0.00	20.0	09Aug13 1024 by 308	09Aug13 1544 by 308		

LABORATORY CONTROL SAMPLE RESULTS

Analyte	Spike Amount	%	Limits	RPD	Limit	Batch	Preparation Date	Analysis Date	Dil	Qual
pH	-	99.6	98.0-102			W44455		07Aug13 1521 by 93		
Ammonia as N	1 mg/l	89.6	80.0-120			W44446	07Aug13 0807 by 308	07Aug13 0858 by 308		
Carbonaceous BOD 5-day	200 mg/l	101	84.5-115			W44465	08Aug13 0806 by 285	13Aug13 0935 by 285		
Total Organic Carbon	10 mg/l	104	80.0-120			W44474	08Aug13 1425 by 308	08Aug13 1610 by 308		
Sodium	5 mg/l	95.2	85.0-115			S35174	08Aug13 1200 by 305	08Aug13 1435 by 305		
	5 mg/l	94.4	85.0-115	0.634	20.0	S35174	08Aug13 1200 by 305	08Aug13 1541 by 305		
Copper	0.05 mg/l	94.6	85.0-115			S35174	08Aug13 1200 by 305	08Aug13 1435 by 305		
	0.05 mg/l	96.1	85.0-115	1.52	20.0	S35174	08Aug13 1200 by 305	08Aug13 1541 by 305		
Copper	0.05 mg/l	95.9	85.0-115			S35194	12Aug13 1430 by 305	12Aug13 1437 by 305		
	0.05 mg/l	97.1	85.0-115	1.17	20.0	S35194	12Aug13 1430 by 305	12Aug13 1613 by 305		
Potassium	5 mg/l	94.8	85.0-115			S35174	08Aug13 1200 by 305	08Aug13 1435 by 305		
	5 mg/l	90.2	85.0-115	4.97	20.0	S35174	08Aug13 1200 by 305	08Aug13 1541 by 305		
Zinc	0.05 mg/l	96.2	85.0-115			S35174	08Aug13 1200 by 305	08Aug13 1435 by 305		
	0.05 mg/l	96.4	85.0-115	0.231	20.0	S35174	08Aug13 1200 by 305	08Aug13 1541 by 305		
Chloride	20 mg/l	103	90.0-110			S35157	07Aug13 1133 by 302	07Aug13 1249 by 302		
Sulfate	20 mg/l	103	90.0-110			S35157	07Aug13 1133 by 302	07Aug13 1249 by 302		
Total Recoverable Copper	0.05 mg/l	94.6	85.0-115			S35174	08Aug13 1200 by 305	08Aug13 1435 by 305		
	0.05 mg/l	96.1	85.0-115	1.52	20.0	S35174	08Aug13 1200 by 305	08Aug13 1541 by 305		
Total Recoverable Zinc	0.05 mg/l	96.2	85.0-115			S35174	08Aug13 1200 by 305	08Aug13 1435 by 305		
	0.05 mg/l	96.4	85.0-115	0.231	20.0	S35174	08Aug13 1200 by 305	08Aug13 1541 by 305		

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MATRIX SPIKE SAMPLE RESULTS

Analyte	Sample	Spike Amount	%	Limits	Batch	Preparation Date	Analysis Date	Dil	Qual
Ammonia as N	169506-1	1 mg/l	-	80.0-120	W44446	07Aug13 0807 by 308	07Aug13 0901 by 308	26	X
	169506-1	1 mg/l	-	80.0-120	W44446	07Aug13 0807 by 308	07Aug13 0903 by 308	26	X
	Relative Percent Difference:		1.08	25.0	W44446				D
Total Organic Carbon	169581-1	10 mg/l	105	80.0-120	W44474	08Aug13 1425 by 308	08Aug13 1639 by 308		
	169581-1	10 mg/l	107	80.0-120	W44474	08Aug13 1425 by 308	08Aug13 1653 by 308		
	Relative Percent Difference:		1.38	25.0	W44474				
Chloride	169524-1	20 mg/l	100	80.0-120	S35157	07Aug13 1133 by 302	07Aug13 1316 by 302		
	169524-1	20 mg/l	99.0	80.0-120	S35157	07Aug13 1133 by 302	07Aug13 1343 by 302		
	Relative Percent Difference:		0.778	10.0	S35157				
Sulfate	169524-1	20 mg/l	109	80.0-120	S35157	07Aug13 1133 by 302	07Aug13 1316 by 302		
	169524-1	20 mg/l	106	80.0-120	S35157	07Aug13 1133 by 302	07Aug13 1343 by 302		
	Relative Percent Difference:		1.19	10.0	S35157				

LABORATORY BLANK RESULTS

Analyte	Result	RL	PQL	QC Sample	Preparation Date	Analysis Date	Qual
Alkalinity as CaCO3	< 1 mg/l	1	1	W44485-1		09Aug13 0910 by 93	
Ammonia as N	< 0.1 mg/l	0.1	0.1	W44446-1	07Aug13 0807 by 308	07Aug13 0856 by 308	
Carbonaceous BOD 5-day	< 2 mg/l	2	2	W44465-1	08Aug13 0806 by 285	13Aug13 0934 by 285	
Total Organic Carbon	< 1 mg/l	1	1	W44474-1	08Aug13 1425 by 308	08Aug13 1556 by 308	
Total Suspended Solids	< 4 mg/l	4	4	W44467-1	08Aug13 0950 by 308	08Aug13 1533 by 308	
Total Suspended Solids	< 4 mg/l	4	4	W44487-1	09Aug13 1024 by 308	09Aug13 1544 by 308	
Sodium	< 1 mg/l	1	1	S35174-1	08Aug13 1200 by 305	08Aug13 1430 by 305	
Copper	< 0.001 mg/l	0.001	0.001	S35174-1	08Aug13 1200 by 305	08Aug13 1430 by 305	
Potassium	< 1 mg/l	1	1	S35174-1	08Aug13 1200 by 305	08Aug13 1430 by 305	
Zinc	< 0.002 mg/l	0.002	0.002	S35174-1	08Aug13 1200 by 305	08Aug13 1430 by 305	
Copper	< 0.001 mg/l	0.001	0.001	S35194-1	12Aug13 1430 by 305	12Aug13 1432 by 305	
Chloride	< 0.2 mg/l	0.2	0.2	S35157-1	07Aug13 1133 by 302	07Aug13 1223 by 302	
Sulfate	< 0.2 mg/l	0.2	0.2	S35157-1	07Aug13 1133 by 302	07Aug13 1223 by 302	
Total Recoverable Copper	< 0.001 mg/l	0.001	0.001	S35174-1	08Aug13 1200 by 305	08Aug13 1430 by 305	
Total Recoverable Zinc	< 0.002 mg/l	0.002	0.002	S35174-1	08Aug13 1200 by 305	08Aug13 1430 by 305	

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CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

169545

Client: VAN BUREN MUNICIPAL UTILITIES
Project Reference: NOTCH PLANT
Project Manager: CLYDE Hill
Sampled By:

PO No.:

AIC CONTROL NO: 169529
AIC PROPOSAL NO:
Carrier: fed-x
Received Temperature C: 2.1

AIC No.	Sample Identification	Date/Time Collected	GRAB	COMP	WATER	SOIL		NO OF BOTTLES	ANALYSES REQUESTED: WGR STUDY	Remarks
	NPEL	8/5-6/13 11:00-11:00Am		X	X			3	X	208/
		Container Type						P		
		Preservative						NO		

Field pH calibration on 8/6 @ 9:30
Buffer: 4-7-10

G = Glass P = Plastic V = VOA vials H = HCl to pH2 T = Sodium Thiosulfate
NO = none S = Sulfuric acid pH2 N = Nitric acid pH2 B = NaOH to pH12 Z = Zinc acetate

Turnaround Time Requested: (Please circle)
NORMAL or EXPEDITED IN ____ DAYS
Expedited results requested by: ____
Who should AIC contact with questions: CLYDE Hill / FTN
Phone:________ Fax:
Report Attention to: FTN
Report Address to:

Relinquished By:	Date/Time	Received By:	Date/Time
	8/6/13 11:33	FEDEX-G 029865615001447	8/6/13 11:33
Relinquished By:	Date/Time	Received in Lab By:	Date/Time
			8-7-13 11:30

Comments:

FORM 0060

3.0 CHEMICAL AND OTHER MEASUREMENTS

Effluent samples collected for each series of tests (including range-finding tests and definitive tests) will be analyzed for the parameters listed in Tables 1.1 and 3.1. This parameter list includes routine NPDES permit parameters that are analyzed to document plant operating conditions and to perform BLM calculations (Di Toro et al. 2001).

Table 3.1. Analytical parameters for water samples to be collected for WER testing.

Parameter	Analytical Method	Reporting Limit (mg/L)
Total Recoverable Copper *	EPA 200.8	0.006
Dissolved copper *	EPA 200.8	0.006
Total Recoverable Zinc *	EPA 200.8	0.006
Dissolved Zinc *	EPA 200.8	0.006
~~Fecal Coliform Bacteria**~~	~~SM 9221, 9222~~	~~10 CFU/100mL~~
Total ammonia	SM 4500 NH3-E	0.1
pH **	HydroLab meter	Not applicable
~~Dissolved Oxygen **~~	~~HydroLab meter~~	~~0.5~~
~~Temperature **~~	~~HydroLab meter~~	~~Not applicable~~
Total Organic Carbon *	EPA 415.1	1.0
Dissolved Organic Carbon *	EPA 415.1	1.0
Hardness*	EPA 130.0	1.0
Total Alkalinity*	EPA 310.0	10
Dissolved Organic Carbon *	EPA 415.1	1.0
TSS *	EPA 160.2	4.0
CBOD5 *	EPA 405.1	2.0
Sodium	EPA 300.0	1.0
Potassium	EPA 300.0	1.0
Chloride	EPA 300.0	1.0
Sulfate	EPA 300.0	1.0

*Parameters also to be measured in laboratory water.
** Measured in effluent at the time of sample arrival to the laboratory.

Samples for the analysis of Cu will be collected from each concentration at the beginning and end of each 24-hour period. The sample for the end of a 24-hour period (and/or the end of the test, as appropriate) for a particular test concentration will be collected by combining all four replicates into a single composite. A portion of the composite will then be filtered through a

October 15, 2013

Test Results of Acute 48 hour Non-Renewal Biomonitoring Testing for

171137-1: Cu Spiked Effluent
171137-2: Cu Spiked Synthetic Water
171137-3: Zn Spiked Synthetic Water
171137-4: Zn Spiked Effluent

Prepared for:

Mr. Pat Downey
FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Prepared by:

AMERICAN INTERPLEX CORPORATION
8600 Kanis Road
Little Rock, AR 72204-2322

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Re: Acute 48 hour Non-Renewal Biomonitoring utilizing *Ceriodaphnia dubia*
Cu Spiked Effluent

Dear Mr. Pat Downey:

Please find enclosed the toxicity data for the Copper and Zinc WER study conducted for Van Buren Municipal Utilities.

If I can be of further assistance, please feel free to contact me.

AMERICAN INTERPLEX CORPORATION

John Overbey
Laboratory Director

PDF cc: FTN Associates, Ltd.
ATTN: Mr. Pat Downey
pjd@ftn-assoc.com

Van Buren Municipal Utilities
ATTN: Mr. Clyde Hill
vbfred@aol.com

Dilution Water Samples: North Plant Effluent

Analysis	Result
Dissolved oxygen (mg/l)	8.0
pH (standard units)	8.5
Alkalinity (mg/l as CaCO3)	23
Hardness (mg/l as CaCO3)	70
Conductivity (umhos/cm)	310
Residual Chlorine (mg/l)	NA

Results Summary: Cu Spiked Effluent

Ceriodaphnia dubia

The *Ceriodaphnia dubia* test was conducted from October 2, 2013 at 1715 to October 4, 2013 at 1520.

Statistical analyses:

NOEC = 150ppb
LC50 = 188.8ppb

Concentration	24 hour % Survival	48 hour % Survival
Control	100	100
19.4ppb	100	100
32.4ppb	100	100
54ppb	100	100
90ppb	100	100
150ppb	100	95.0
250ppb	0.00	0.00 *

*Significant difference compared to the control (p=0.05)

Ceriodaphnia dubia
Survival Data

Number of organisms per chamber: 5 | Age of organisms: <24 hours
Volume of test chamber: 30 ml | Volume of test solution: 15 ml

Effluent Concentration		Number of Survivors 24 Hours	48 Hours	% Survival	CV %
Control	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
19.4ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
32.4ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
54ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
90ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
150ppb	rep. A	5	5	95.0	10.5
	rep. B	5	5		
	rep. C	5	4		
	rep. D	5	5		
250ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		

CV = Coefficient of variance = standard deviation X 100/mean

Ceriodaphnia dubia

Transformation of Data — Transform: Arc Sin(Square Root(Y))

Group	Identification	Rep	Value	Transformed
1	Control	1	1.00000	1.34530
1	Control	2	1.00000	1.34530
1	Control	3	1.00000	1.34530
1	Control	4	1.00000	1.34530
2	19.4ppb	1	1.00000	1.34530
2	19.4ppb	2	1.00000	1.34530
2	19.4ppb	3	1.00000	1.34530
2	19.4ppb	4	1.00000	1.34530
3	32.4ppb	1	1.00000	1.34530
3	32.4ppb	2	1.00000	1.34530
3	32.4ppb	3	1.00000	1.34530
3	32.4ppb	4	1.00000	1.34530
4	54ppb	1	1.00000	1.34530
4	54ppb	2	1.00000	1.34530
4	54ppb	3	1.00000	1.34530
4	54ppb	4	1.00000	1.34530
5	90ppb	1	1.00000	1.34530
5	90ppb	2	1.00000	1.34530
5	90ppb	3	1.00000	1.34530
5	90ppb	4	1.00000	1.34530
6	150ppb	1	1.00000	1.34530
6	150ppb	2	1.00000	1.34530
6	150ppb	3	0.80000	1.10710
6	150ppb	4	1.00000	1.34530
7	250ppb	1	0.00000	0.22551
7	250ppb	2	0.00000	0.22551
7	250ppb	3	0.00000	0.22551
7	250ppb	4	0.00000	0.22551

Ceriodaphnia dubia

Shapiro - Wilk's Test for Normality	Transform: Arc Sin(Square Root(Y))
D = 0.04255	
W = 0.4337	
Critical W = 0.896	(alpha = 0.01, N = 28)
Critical W = 0.924	(alpha = 0.05, N = 28)

Data FAIL normality test (alpha = 0.01).

Steel's Many-One Rank Test — Transform: Arc Sin(Square Root(Y))

Ho:Control<Treatment

Group	Identification	Rank Sum	Critical Value	DF	Sig 0.05
1	Control				
2	19.4ppb	18.00	10.00	4.00	
3	32.4ppb	18.00	10.00	4.00	
4	54ppb	18.00	10.00	4.00	
5	90ppb	18.00	10.00	4.00	
6	150ppb	16.00	10.00	4.00	
7	250ppb	10.00	10.00	4.00	*

Critical values are 1 tailed (k=6)

Ceriodaphnia dubia

Spearman-Karber Method for Calculating LC50 Values

Concentration	Number Exposed	Number Responding	Proportion Responding	Smoothed Proportion	Smoothed Adjusted Proportion
Control	20	0	0	0	0
19.4	20	0	0	0	0
32.4	20	0	0	0	0
54	20	0	0	0	0
90	20	0	0	0	0
150	20	1	0.05	0.05	0.05
250	20	20	1	1	1

LC50 = 188.8
Upper Confidence Limit = 198.7
Lower Confidence Limit = 179.4

Variance = 0.000123

Chemical Data for
Ceriodaphnia dubia

Day 1		Control	19.4ppb	32.4ppb	54ppb	90ppb	150ppb	250ppb
DO, mg/l	Initial	8.0	8.4	8.4	8.4	8.4	8.3	8.4
DO, mg/l	Final	7.6	7.7	7.9	7.8	7.9	7.6	7.7
pH, su	Initial	8.5	8.5	8.5	8.5	8.5	9.0	8.5
pH, su	Final	8.0	8.1	8.0	8.0	8.0	8.0	8.1
Alkalinity, mg/l		23	NA	NA	NA	NA	NA	NA
Hardness, mg/l		70	NA	NA	NA	NA	NA	NA
Conductivity, umho/cm		310	310	310	310	310	310	490

Day 2		Control	19.4ppb	32.4ppb	54ppb	90ppb	150ppb	250ppb
DO, mg/l	Final	8.0	8.0	8.0	8.0	8.1	8.1	7.9
pH, su	Final	7.8	7.8	7.8	7.3	7.7	7.8	7.8

AMERICAN INTERPLEX CORPORATION LABORATORIES

COPY

171137

CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

PAGE OF

Client: VAN BUREN MONICIPAL UTILITIES
Project Reference: NORTH PLANT
Project Manager: CLYDE Hill
Sampled By: [signature]
PO No.:
AIC CONTROL NO: ~~171106~~ GE(177)
AIC PROPOSAL NO:
Carrier/Tracking No. Fed-X
Received Temperature C: 3.1

AIC No.	Sample Identification	Date/Time Collected	GRAB	COMP	WATER	SOIL		NO OF BOTTLES	WER STODY											Remarks
1	NPE1	9/29-30/13 8:00-8:15 Am		X	X			3	X											6.93/5°
																				Field pH calibration
		Container Type						P												on 9/30 @ 7:45
		Preservative						NO												Buffer: 4.7

G = Glass / P = Plastic / V = VOA vials / H = HCl to pH2 / T = Sodium Thiosulfate
NO = none / S = Sulfuric acid pH2 / N = Nitric acid pH2 / B = NaOH to pH12 / Z = Zinc acetate

Turnaround Time Requested: (Please circle)
NORMAL or EXPEDITED IN ___ DAYS
Expedited results requested by:
Who should AIC contact with questions: Clyde Hill / FTN
Phone: 479-719-6508 Fax:
Report Attention to: VBFred@aol.com
Report Address to:

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	9/30/13 10:47	FEDEX-C 029865615001485	9/30/13 10:47
Relinquished By:	Date/Time	Received in Lab By: [signature]	10-1-13 1225

Comments: 9612019 0298 656 1500148<

19-Oct-09

FORM 0060

AMERICAN INTERPLEX CORPORATION
LABORATORIES

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Re: Acute 48 hour Non-Renewal Biomonitoring utilizing *Ceriodaphnia dubia*
Cu Spiked Synthetic Water

Dilution Water Samples: Synthetic Moderately Hard Water #4025

Analysis	Result
Dissolved oxygen (mg/l)	8.6
pH (standard units)	7.7
Alkalinity (mg/l as CaCO3)	64
Hardness (mg/l as CaCO3)	81
Conductivity (umhos/cm)	380
Residual Chlorine (mg/l)	<0.05

Results Summary: Cu Spiked Synthetic Water

Ceriodaphnia dubia

The *Ceriodaphnia dubia* test was conducted from October 2, 2013 at 1700 to October 4, 2013 at 1505.

Statistical analyses:

NOEC = 6.48ppb
LC50 = 7.75ppb

Concentration	24 hour % Survival	48 hour % Survival	
Control	100	100	
3.89ppb	100	100	
6.48ppb	100	75.0	
10.8ppb	90.0	10.0	*
18ppb	0.00	0.00	*
30ppb	0.00	0.00	*
50ppb	0.00	0.00	*

*Significant difference compared to the control (p=0.05)

Ceriodaphnia dubia
Survival Data

Number of organisms per chamber: 5
Volume of test chamber: 30 ml

Age of organisms: <24 hours
Volume of test solution: 15 ml

Effluent Concentration		Number of Survivors 24 Hours	48 Hours	% Survival	CV %
Control	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
3.89ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
6.48ppb	rep. A	5	3	75.0	25.5
	rep. B	5	3		
	rep. C	5	4		
	rep. D	5	5		
10.8ppb	rep. A	5	1	10.0	115
	rep. B	5	0		
	rep. C	5	0		
	rep. D	3	1		
18ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		
30ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		
50ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		

CV = Coefficient of variance = standard deviation X 100/mean

Ceriodaphnia dubia

	Transformation of Data		Transform: Arc Sin(Square Root(Y))	
Group	Identification	Rep	Value	Transformed
1	Control	1	1.00000	1.34530
1	Control	2	1.00000	1.34530
1	Control	3	1.00000	1.34530
1	Control	4	1.00000	1.34530
2	3.89ppb	1	1.00000	1.34530
2	3.89ppb	2	1.00000	1.34530
2	3.89ppb	3	1.00000	1.34530
2	3.89ppb	4	1.00000	1.34530
3	6.48ppb	1	0.60000	0.88608
3	6.48ppb	2	0.60000	0.88608
3	6.48ppb	3	0.80000	1.10710
3	6.48ppb	4	1.00000	1.34530
4	10.8ppb	1	0.20000	0.46365
4	10.8ppb	2	0.00000	0.22551
4	10.8ppb	3	0.00000	0.22551
4	10.8ppb	4	0.20000	0.46365
5	18ppb	1	0.00000	0.22551
5	18ppb	2	0.00000	0.22551
5	18ppb	3	0.00000	0.22551
5	18ppb	4	0.00000	0.22551
6	30ppb	1	0.00000	0.22551
6	30ppb	2	0.00000	0.22551
6	30ppb	3	0.00000	0.22551
6	30ppb	4	0.00000	0.22551
7	50ppb	1	0.00000	0.22551
7	50ppb	2	0.00000	0.22551
7	50ppb	3	0.00000	0.22551
7	50ppb	4	0.00000	0.22551

Ceriodaphnia dubia

Shapiro - Wilk's Test for Normality	Transform: Arc Sin(Square Root(Y))
D = 0.2008	
W = 0.7253	
Critical W = 0.896	(alpha = 0.01, N = 28)
Critical W = 0.924	(alpha = 0.05, N = 28)

Data FAIL normality test (alpha = 0.01).

Steel's Many-One Rank Test — Transform: Arc Sin(Square Root(Y))

Ho:Control<Treatment

Group	Identification	Rank Sum	Critical Value	DF	Sig 0.05
1	Control				
2	3.89ppb	18.00	10.00	4.00	
3	6.48ppb	12.00	10.00	4.00	
4	10.8ppb	10.00	10.00	4.00	*
5	18ppb	10.00	10.00	4.00	*
6	30ppb	10.00	10.00	4.00	*
7	50ppb	10.00	10.00	4.00	*

Critical values are 1 tailed (k=6)

Ceriodaphnia dubia

Probit Analysis for Calculating LC/EC Values

Concentration	Number Exposed	Number Responding	Observed Proportion Responding	Proportion Responding Adjusted for Controls	Predicted Proportion Responding
3.89	20	0	0	0	0.0031
6.48	20	5	0.25	0.25	0.2382
10.8	20	18	0.9	0.9	0.9062
18	20	20	1	1	0.9996
30	20	20	1	1	1
50	20	20	1	1	1

Chi - Square for Heterogeneity (calculated) = 0.09427
Chi - Square for Heterogeneity (tabular value at 0.05 level) = 9.488

Mu = 0.8894
Sigma = 0.1093

Parameter	Estimate	Std. Error	Lower 95% Conf.	Upper 95% Conf.
Intercept	-3.139	1.74	-6.549	0.2709
Slope	9.151	1.938	5.352	12.95

Theoretical Spontaneous Response Rate = 0

Estimated LC/EC Values and Confidence Limits

LC/EC Point	Exposure Conc.	Lower 95% Conf.	Upper 95% Conf.
1	4.317	2.775	5.265
5	5.125	3.684	6
10	5.615	4.272	6.454
15	5.972	4.711	6.794
50	7.752	6.819	8.815
85	10.06	8.843	12.76
90	10.7	9.309	14.07
95	11.73	10.01	16.32
99	13.92	11.41	21.67

Chemical Data for
Ceriodaphnia dubia

Day 1		Control	3.89ppb	6.48ppb	10.8ppb	18ppb	30ppb	50ppb
DO, mg/l	Initial	8.6	8.0	7.9	7.9	8.0	8.3	7.8
DO, mg/l	Final	7.4	7.6	7.6	7.8	7.7	7.6	8.0
pH, su	Initial	7.7	7.8	7.8	7.8	7.8	7.8	7.8
pH, su	Final	7.5	7.5	7.5	7.5	7.5	7.4	7.6
Alkalinity, mg/l		64	NA	NA	NA	NA	NA	NA
Hardness, mg/l		81	NA	NA	NA	NA	NA	NA
Conductivity, umho/cm		380	380	380	380	380	380	380
Residual Chlorine, mg/l		<0.05	NA	NA	NA	NA	NA	NA

Day 2		Control	3.89ppb	6.48ppb	10.8ppb	18ppb	30ppb	50ppb
DO, mg/l	Final	8.0	8.1	7.9	8.0	8.0	8.1	8.0
pH, su	Final	7.4	7.2	7.3	7.3	7.3	7.3	7.4

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

This report contains the analytical results and supporting information for samples submitted on October 1, 2013. Attached please find a copy of the Chain of Custody and/or other documents received. Note that any remaining sample will be discarded two weeks from the original report date unless other arrangements are made.

This report is intended for the sole use of the client listed above. Assessment of the data requires access to the entire document.

This report has been reviewed by the Laboratory Director or a qualified designee.

John Overbey
Laboratory Director

This document has been distributed to the following:

PDF cc: FTN Associates, Ltd.
ATTN: Mr. Pat Downey
pjd@ftn-assoc.com

Van Buren Municipal Utilities
ATTN: Mr. Clyde Hill
vbfred@aol.com

AMERICAN INTERPLEX CORPORATION LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

SAMPLE INFORMATION

Project Description:
Two (2) water sample(s) received on October 1, 2013
North Plant

Receipt Details:
A Chain of Custody was not provided. The samples were delivered in one (1) ice chest.

Each sample container was checked for proper labeling, including date and time sampled. Sample containers were reviewed for proper type, adequate volume, integrity, temperature, preservation, and holding times. Any exceptions are noted below:

Sample Identification:

Laboratory ID	Client Sample ID	Sampled Date/Time	Notes
171106-1	NPE 1 9/29-30/13 8:00-8:15am	30-Sep-2013 0815	
171106-2	MOD Water		
171106-3	Effluent 250ppb Cu Initial		
171106-4	Effluent 150ppb Cu Initial		
171106-5	Effluent 90ppb Cu Initial		
171106-6	Effluent 54ppb Cu Initial		
171106-7	Effluent 32.4ppb Cu Initial		
171106-8	Effluent 19.4ppb Cu Initial		
171106-9	Synthetic MOD 50ppb Cu Initial		
171106-10	Synthetic MOD 30ppb Cu Initial		
171106-11	Synthetic MOD 18ppb Cu Initial		
171106-12	Synthetic MOD 10.8ppb Cu Initial		
171106-13	Synthetic MOD 6.48ppb Cu Initial		
171106-14	Synthetic MOD 3.89ppb Cu Initial		
171106-15	Effluent 250ppb Cu Final		
171106-16	Effluent 150ppb Cu Final		
171106-17	Effluent 90ppb Cu Final		
171106-18	Effluent 54ppb Cu Final		
171106-19	Effluent 32.4ppb Cu Final		
171106-20	Effluent 19.4ppb Cu Final		
171106-21	Synthetic MOD 50ppb Cu Final		
171106-22	Synthetic MOD 30ppb Cu Final		
171106-23	Synthetic MOD 18ppb Cu Final		
171106-24	Synthetic MOD 10.8ppb Cu Final		
171106-25	Synthetic MOD 6.48ppb Cu Final		
171106-26	Synthetic MOD 3.89ppb Cu Final		
171106-27	Effluent 250ppb Zn Initial		
171106-28	Effluent 150ppb Zn Initial		
171106-29	Effluent 90ppb Zn Initial		
171106-30	Effluent 54ppb Zn Initial		
171106-31	Effluent 32.4ppb Zn Initial		
171106-32	Effluent 19.4ppb Zn Initial		
171106-33	Synthetic MOD 250ppb Zn Initial		
171106-34	Synthetic MOD 150ppb Zn Initial		
171106-35	Synthetic MOD 90ppb Zn Initial		
171106-36	Synthetic MOD 54ppb Zn Initial		
171106-37	Synthetic MOD 32.4ppb Zn Initial		

AMERICAN INTERPLEX CORPORATION LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

SAMPLE INFORMATION

Laboratory ID	Client Sample ID	Sampled Date/Time	Notes
171106-38	Synthetic MOD 19.4ppb Zn Initial		
171106-39	Effluent 250ppb Zn Final		
171106-40	Effluent 150ppb Zn Final		
171106-41	Effluent 90ppb Zn Final		
171106-42	Effluent 54ppb Zn Final		
171106-43	Effluent 32.4ppb Zn Final		
171106-44	Effluent 19.4ppb Zn Final		
171106-45	Synthetic MOD 250ppb Zn Final		
171106-46	Synthetic MOD 150ppb Zn Final		
171106-47	Synthetic MOD 90ppb Zn Final		
171106-48	Synthetic MOD 54ppb Zn Final		
171106-49	Synthetic MOD 32.4ppb Zn Final		
171106-50	Synthetic MOD 19.4ppb Zn Final		

Qualifiers:

- D Result is from a secondary dilution factor
- H Analytical holding time exceeded regulatory requirements
- X Spiking level is invalid due to the high concentration of analyte in the spiked sample

Case Narrative:

Table II of 40 CFR Part 136.3 indicates analysis of pH, Total Residual Chlorine, and Dissolved Oxygen are to be performed on site or immediately after collection. American Interplex Corporation analyzes these parameters as soon as possible after laboratory receipt.

References:

"Methods for Chemical Analysis of Water and Wastes", EPA/600/4-79-020 (Mar 1983) with updates and supplements EPA/600/5-91-010 (Jun 1991), EPA/600/R-92-129 (Aug 1992) and EPA/600/R-93-100 (Aug 1993).
"Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846)", Third Edition.
"Standard Methods for the Examination of Water and Wastewaters", 21st edition.
"American Society for Testing and Materials" (ASTM).
"Association of Analytical Chemists" (AOAC).

AMERICAN INTERPLEX CORPORATION LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 171106-1
Sample Identification: NPE 1 9/29-30/13 8:00-8:15am

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3 SM 2320 B		**23** Analyzed: 02-Oct-2013 1510 by 93	1	**mg/l** Batch: W45122	
pH SM 4500-H+ B		**7.4** Analyzed: 01-Oct-2013 1709 by 93		**Units** Batch: W45107	H
Ammonia as N SM 4500-NH3 G	Prep: 03-Oct-2013 0858 by 308	**0.21** Analyzed: 03-Oct-2013 1018 by 308	0.1	**mg/l** Batch: W45136	
Carbonaceous BOD 5-day SM 5210 B	Prep: 02-Oct-2013 0808 by 285	**< 2** Analyzed: 07-Oct-2013 1134 by 285	2	**mg/l** Batch: W45114	
Total Organic Carbon SM 5310 C	Prep: 02-Oct-2013 1615 by 308	**6.7** Analyzed: 02-Oct-2013 2034 by 308	1	**mg/l** Batch: W45124	
Total Suspended Solids USGS 3765	Prep: 03-Oct-2013 1607 by 285	**< 4** Analyzed: 04-Oct-2013 1151 by 285	4	**mg/l** Batch: W45147	
Potassium EPA 200.8	Prep: 02-Oct-2013 1400 by 305	**11** Analyzed: 04-Oct-2013 1411 by 305	1	**mg/l** Batch: S35522	
Sodium EPA 200.8	Prep: 02-Oct-2013 1400 by 305	**37** Analyzed: 04-Oct-2013 1411 by 305	1	**mg/l** Batch: S35522	
Hardness as CaCO3 SM 2340 B	Prep: 02-Oct-2013 1400 by 305	**70** Analyzed: 04-Oct-2013 1411 by 305	1	**mg/l** Batch: S35522	
Chloride EPA 300.0	Prep: 01-Oct-2013 1747 by 07	**36** Analyzed: 01-Oct-2013 2045 by 07	0.2	**mg/l** Batch: C16081	
Sulfate EPA 300.0	Prep: 01-Oct-2013 1747 by 07	**20** Analyzed: 01-Oct-2013 2045 by 07	0.2	**mg/l** Batch: C16081	
Dissolved Organic Carbon SM 5310 C	Prep: 02-Oct-2013 1616 by 308	**5.7** Analyzed: 02-Oct-2013 2102 by 308	1	**mg/l** Batch: W45124	
Dissolved Copper EPA 200.8	Prep: 02-Oct-2013 1400 by 305	**9.47** Analyzed: 04-Oct-2013 1405 by 305	1	**ug/l** Batch: S35522	
Dissolved Zinc EPA 200.8	Prep: 02-Oct-2013 1400 by 305	**61.1** Analyzed: 04-Oct-2013 1405 by 305	2	**ug/l** Batch: S35522	
Total Recoverable Copper EPA 200.8	Prep: 02-Oct-2013 1400 by 305	**11.2** Analyzed: 04-Oct-2013 1411 by 305	1	**ug/l** Batch: S35522	
Total Recoverable Zinc EPA 200.8	Prep: 02-Oct-2013 1400 by 305	**64.9** Analyzed: 04-Oct-2013 1411 by 305	2	**ug/l** Batch: S35522	

AIC No. 171106-2
Sample Identification: MOD Water

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3 SM 2320 B		**64** Analyzed: 02-Oct-2013 1510 by 93	1	**mg/l** Batch: W45122	
pH SM 4500-H+ B		**8.1** Analyzed: 02-Oct-2013 1818 by 93		**Units** Batch: W45128	

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ANALYTICAL RESULTS

AIC No. 171106-2 (Continued)
Sample Identification: MOD Water

Analyte		Result	RL	Units	Qualifier
Ammonia as N		**< 0.1**	0.1	**mg/l**	
SM 4500-NH3 G	Prep: 03-Oct-2013 0858 by 308	Analyzed: 03-Oct-2013 1020 by 308		Batch: W45136	
Carbonaceous BOD 5-day		**< 2**	2	**mg/l**	
SM 5210 B	Prep: 03-Oct-2013 0810 by 285	Analyzed: 08-Oct-2013 0925 by 308		Batch: W45132	
Total Organic Carbon		**< 1**	1	**mg/l**	
SM 5310 C	Prep: 02-Oct-2013 1615 by 308	Analyzed: 02-Oct-2013 2048 by 308		Batch: W45124	
Total Suspended Solids		**< 4**	4	**mg/l**	
USGS 3765	Prep: 03-Oct-2013 1607 by 285	Analyzed: 04-Oct-2013 1151 by 285		Batch: W45147	
Potassium		**1.8**	1	**mg/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 02-Oct-2013 1623 by 305		Batch: S35522	
Sodium		**25**	1	**mg/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 02-Oct-2013 1623 by 305		Batch: S35522	
Hardness as CaCO3		**81**	1	**mg/l**	
SM 2340 B	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1200 by 305		Batch: S35522	
Chloride		**1.9**	0.2	**mg/l**	
EPA 300.0	Prep: 02-Oct-2013 1443 by 07	Analyzed: 02-Oct-2013 2012 by 07		Batch: C16086	
Sulfate		**85**	2	**mg/l**	D
EPA 300.0	Prep: 02-Oct-2013 1443 by 07	Analyzed: 02-Oct-2013 1946 by 07		Batch: C16086	Dil: 10
Dissolved Organic Carbon		**< 1**	1	**mg/l**	
SM 5310 C	Prep: 02-Oct-2013 1616 by 308	Analyzed: 03-Oct-2013 0944 by 308		Batch: W45124	
Dissolved Copper		**< 1**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 02-Oct-2013 1725 by 305		Batch: S35522	
Dissolved Zinc		**< 2**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 02-Oct-2013 1725 by 305		Batch: S35522	
Total Recoverable Copper		**< 1**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 02-Oct-2013 1623 by 305		Batch: S35522	
Total Recoverable Zinc		**< 2**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 02-Oct-2013 1623 by 305		Batch: S35522	

AIC No. 171106-3
Sample Identification: Effluent 250ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**233**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1526 by 305		Batch: S35522	
Dissolved Copper		**217**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1521 by 305		Batch: S35522	

AIC No. 171106-4
Sample Identification: Effluent 150ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**146**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1515 by 305		Batch: S35522	

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ANALYTICAL RESULTS

AIC No. 171106-4 (Continued)
Sample Identification: Effluent 150ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Copper		**126**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1510 by 305		Batch: S35522	

AIC No. 171106-5
Sample Identification: Effluent 90ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**91.8**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1454 by 305		Batch: S35522	
Dissolved Copper		**82.3**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1448 by 305		Batch: S35522	

AIC No. 171106-6
Sample Identification: Effluent 54ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**62.2**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1443 by 305		Batch: S35522	
Dissolved Copper		**47.0**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1438 by 305		Batch: S35522	

AIC No. 171106-7
Sample Identification: Effluent 32.4ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**43.9**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1432 by 305		Batch: S35522	
Dissolved Copper		**39.8**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1427 by 305		Batch: S35522	

AIC No. 171106-8
Sample Identification: Effluent 19.4ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**28.5**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1422 by 305		Batch: S35522	
Dissolved Copper		**25.4**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1416 by 305		Batch: S35522	

AIC No. 171106-9
Sample Identification: Synthetic MOD 50ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**48.4**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 02-Oct-2013 1649 by 305		Batch: S35522	

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ANALYTICAL RESULTS

AIC No. 171106-9 (Continued)
Sample Identification: Synthetic MOD 50ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Copper		**48.4**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 02-Oct-2013 1747 by 305		Batch: S35522	

AIC No. 171106-10
Sample Identification: Synthetic MOD 30ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**29.6**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1713 by 305		Batch: S35522	
Dissolved Copper		**29.6**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1708 by 305		Batch: S35522	

AIC No. 171106-11
Sample Identification: Synthetic MOD 18ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**18.2**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1702 by 305		Batch: S35522	
Dissolved Copper		**17**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1645 by 305		Batch: S35522	

AIC No. 171106-12
Sample Identification: Synthetic MOD 10.8ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**10.2**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1640 by 305		Batch: S35522	
Dissolved Copper		**9.17**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1634 by 305		Batch: S35522	

AIC No. 171106-13
Sample Identification: Synthetic MOD 6.48ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**5.70**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1629 by 305		Batch: S35522	
Dissolved Copper		**4.80**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1624 by 305		Batch: S35522	

AIC No. 171106-14
Sample Identification: Synthetic MOD 3.89ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**3.00**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1618 by 305		Batch: S35522	

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ANALYTICAL RESULTS

AIC No. 171106-14 (Continued)
Sample Identification: Synthetic MOD 3.89ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Copper		**2.80**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1613 by 305		Batch: S35522	

AIC No. 171106-15
Sample Identification: Effluent 250ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**222**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2106 by 305		Batch: S35545	
Dissolved Copper		**189**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2101 by 305		Batch: S35545	

AIC No. 171106-16
Sample Identification: Effluent 150ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**136**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2055 by 305		Batch: S35545	
Dissolved Copper		**126**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2050 by 305		Batch: S35545	

AIC No. 171106-17
Sample Identification: Effluent 90ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**85.6**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2045 by 305		Batch: S35545	
Dissolved Copper		**77.3**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2039 by 305		Batch: S35545	

AIC No. 171106-18
Sample Identification: Effluent 54ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**54.3**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2034 by 305		Batch: S35545	
Dissolved Copper		**48.0**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2028 by 305		Batch: S35545	

AIC No. 171106-19
Sample Identification: Effluent 32.4ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**37.4**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2012 by 305		Batch: S35545	

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ANALYTICAL RESULTS

AIC No. 171106-19 (Continued)
Sample Identification: Effluent 32.4ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Dissolved Copper		**32.7**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2007 by 305		Batch: S35545	

AIC No. 171106-20
Sample Identification: Effluent 19.4ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**25.4**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2002 by 305		Batch: S35545	
Dissolved Copper		**24.2**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1956 by 305		Batch: S35545	

AIC No. 171106-21
Sample Identification: Synthetic MOD 50ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**45.9**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1951 by 305		Batch: S35545	
Dissolved Copper		**44.0**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1946 by 305		Batch: S35545	

AIC No. 171106-22
Sample Identification: Synthetic MOD 30ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**25.9**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1940 by 305		Batch: S35545	
Dissolved Copper		**23.5**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1935 by 305		Batch: S35545	

AIC No. 171106-23
Sample Identification: Synthetic MOD 18ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**15.7**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1929 by 305		Batch: S35545	
Dissolved Copper		**12.7**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1924 by 305		Batch: S35545	

AIC No. 171106-24
Sample Identification: Synthetic MOD 10.8ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**8.46**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1908 by 305		Batch: S35545	

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ANALYTICAL RESULTS

AIC No. 171106-24 (Continued)
Sample Identification: Synthetic MOD 10.8ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Dissolved Copper		**6.91**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1903 by 305		Batch: S35545	

AIC No. 171106-25
Sample Identification: Synthetic MOD 6.48ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**5.12**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1857 by 305		Batch: S35545	
Dissolved Copper		**3.96**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1852 by 305		Batch: S35545	

AIC No. 171106-26
Sample Identification: Synthetic MOD 3.89ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**2.61**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1846 by 305		Batch: S35545	
Dissolved Copper		**2.03**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1841 by 305		Batch: S35545	

AIC No. 171106-27
Sample Identification: Effluent 250ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**236**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1636 by 305		Batch: S35522	
Dissolved Zinc		**236**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1648 by 305		Batch: S35522	

AIC No. 171106-28
Sample Identification: Effluent 150ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**169**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1630 by 305		Batch: S35522	
Dissolved Zinc		**160**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1625 by 305		Batch: S35522	

AIC No. 171106-29
Sample Identification: Effluent 90ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**132**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1620 by 305		Batch: S35522	

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ANALYTICAL RESULTS

AIC No. 171106-29 (Continued)
Sample Identification: Effluent 90ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**125**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1614 by 305		Batch: S35522	

AIC No. 171106-30
Sample Identification: Effluent 54ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**101**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1558 by 305		Batch: S35522	
Dissolved Zinc		**98.7**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1553 by 305		Batch: S35522	

AIC No. 171106-31
Sample Identification: Effluent 32.4ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**90.6**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1547 by 305		Batch: S35522	
Dissolved Zinc		**88.8**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1542 by 305		Batch: S35522	

AIC No. 171106-32
Sample Identification: Effluent 19.4ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**76.6**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1531 by 305		Batch: S35522	
Dissolved Zinc		**75.5**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1537 by 305		Batch: S35522	

AIC No. 171106-33
Sample Identification: Synthetic MOD 250ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**237**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1938 by 305		Batch: S35527	
Dissolved Zinc		**222**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1944 by 305		Batch: S35527	

AIC No. 171106-34
Sample Identification: Synthetic MOD 150ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**138**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1922 by 305		Batch: S35527	

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ANALYTICAL RESULTS

AIC No. 171106-34 (Continued)
Sample Identification: Synthetic MOD 150ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**138**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1559 by 305		Batch: S35527	

AIC No. 171106-35
Sample Identification: Synthetic MOD 90ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**90.8**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1911 by 305		Batch: S35527	
Dissolved Zinc		**86.5**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1906 by 305		Batch: S35527	

AIC No. 171106-36
Sample Identification: Synthetic MOD 54ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**50.4**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1855 by 305		Batch: S35527	
Dissolved Zinc		**47.2**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1901 by 305		Batch: S35527	

AIC No. 171106-37
Sample Identification: Synthetic MOD 32.4ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**34.3**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1845 by 305		Batch: S35527	
Dissolved Zinc		**34.0**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1850 by 305		Batch: S35527	

AIC No. 171106-38
Sample Identification: Synthetic MOD 19.4ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**19.3**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1834 by 305		Batch: S35527	
Dissolved Zinc		**18.7**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1839 by 305		Batch: S35527	

AIC No. 171106-39
Sample Identification: Effluent 250ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**263**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 14-Oct-2013 1945 by 305		Batch: S35546	

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ANALYTICAL RESULTS

AIC No. 171106-39 (Continued)
Sample Identification: Effluent 250ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**213**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 14-Oct-2013 1939 by 305		Batch: S35546	

AIC No. 171106-40
Sample Identification: Effluent 150ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**172**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1607 by 305		Batch: S35546	
Dissolved Zinc		**154**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1601 by 305		Batch: S35546	

AIC No. 171106-41
Sample Identification: Effluent 90ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**137**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1556 by 305		Batch: S35546	
Dissolved Zinc		**122**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1551 by 305		Batch: S35546	

AIC No. 171106-42
Sample Identification: Effluent 54ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**96.0**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1545 by 305		Batch: S35546	
Dissolved Zinc		**96.9**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1540 by 305		Batch: S35546	

AIC No. 171106-43
Sample Identification: Effluent 32.4ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**81.4**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1535 by 305		Batch: S35546	
Dissolved Zinc		**81.0**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1529 by 305		Batch: S35546	

AIC No. 171106-44
Sample Identification: Effluent 19.4ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**78.3**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 14-Oct-2013 1934 by 305		Batch: S35546	

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ANALYTICAL RESULTS

AIC No. 171106-44 (Continued)
Sample Identification: Effluent 19.4ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**69.7**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 14-Oct-2013 1929 by 305		Batch: S35546	

AIC No. 171106-45
Sample Identification: Synthetic MOD 250ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**225**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1458 by 305		Batch: S35546	
Dissolved Zinc		**211**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1453 by 305		Batch: S35546	

AIC No. 171106-46
Sample Identification: Synthetic MOD 150ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**132**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1447 by 305		Batch: S35546	
Dissolved Zinc		**125**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1442 by 305		Batch: S35546	

AIC No. 171106-47
Sample Identification: Synthetic MOD 90ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**89.1**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1437 by 305		Batch: S35546	
Dissolved Zinc		**84.4**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1431 by 305		Batch: S35546	

AIC No. 171106-48
Sample Identification: Synthetic MOD 54ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**52.0**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1426 by 305		Batch: S35546	
Dissolved Zinc		**46.5**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1420 by 305		Batch: S35546	

AIC No. 171106-49
Sample Identification: Synthetic MOD 32.4ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**34.0**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1415 by 305		Batch: S35546	

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ANALYTICAL RESULTS

AIC No. 171106-49 (Continued)
Sample Identification: Synthetic MOD 32.4ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**33.0**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1410 by 305		Batch: S35546	

AIC No. 171106-50
Sample Identification: Synthetic MOD 19.4ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**22.9**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2117 by 305		Batch: S35546	
Dissolved Zinc		**20.2**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2111 by 305		Batch: S35546	

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DUPLICATE RESULTS

Analyte		AIC No.	Result	RPD	RPD Limit	Preparation Date	Analysis Date	Dil	Qual
pH		171094-1	7.3 Units				01Oct13 1057 by 93		H
	Batch: W45107	Duplicate	7.3 Units	0.274	5.00		01Oct13 1058 by 93		H
Carbonaceous BOD 5-day		171073-1	< 2 mg/l			02Oct13 0808 by 285	07Oct13 1124 by 285		
	Batch: W45114	Duplicate	< 2 mg/l	0.00	20.0	02Oct13 0808 by 285	07Oct13 1126 by 285		
Alkalinity as CaCO3		171106-2	64 mg/l				02Oct13 1510 by 93		
	Batch: W45122	Duplicate	63 mg/l	1.42	20.0		02Oct13 1510 by 93		
pH		171106-2	8.1 Units				02Oct13 1818 by 93		
	Batch: W45128	Duplicate	8.1 Units	0.00	5.00		02Oct13 1819 by 93		
Carbonaceous BOD 5-day		171154-1	< 2 mg/l			03Oct13 0810 by 285	08Oct13 0846 by 285		
	Batch: W45132	Duplicate	< 2 mg/l	0.00	20.0	03Oct13 0810 by 285	08Oct13 0848 by 285		
Total Suspended Solids		171106-1	< 4 mg/l			03Oct13 1607 by 285	04Oct13 1151 by 285		
	Batch: W45147	Duplicate	< 4 mg/l	0.00	20.0	03Oct13 1607 by 285	04Oct13 1151 by 285		
Total Suspended Solids		171106-2	< 4 mg/l			03Oct13 1607 by 285	04Oct13 1151 by 285		
	Batch: W45147	Duplicate	< 4 mg/l	0.00	20.0	03Oct13 1607 by 285	04Oct13 1151 by 285		

AMERICAN INTERPLEX CORPORATION LABORATORIES

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LABORATORY CONTROL SAMPLE RESULTS

Analyte	Spike Amount	%	Limits	RPD	Limit	Batch	Preparation Date	Analysis Date	Dil	Qual
pH	-	100	98.0-102			W45107		01Oct13 1058 by 93		
pH	-	100	98.0-102			W45128		02Oct13 1819 by 93		
Ammonia as N	1 mg/l	92.3	80.0-120			W45136	03Oct13 0859 by 308	03Oct13 0959 by 308		
Carbonaceous BOD 5-day	200 mg/l	104	84.5-115			W45114	02Oct13 0808 by 285	07Oct13 1123 by 285		
Carbonaceous BOD 5-day	200 mg/l	107	84.5-115			W45132	03Oct13 0810 by 285	08Oct13 0844 by 285		
Total Organic Carbon	10 mg/l	98.5	80.0-120			W45124	02Oct13 1616 by 308	02Oct13 1758 by 308		
Copper	0.05 mg/l	98.2	85.0-115			S35522	02Oct13 1400 by 305	03Oct13 1357 by 305		
	0.05 mg/l	97.8	85.0-115	0.402	20.0	S35522	02Oct13 1400 by 305	03Oct13 1501 by 305		
Copper	0.05 mg/l	99.5	85.0-115			S35545	07Oct13 1400 by 305	07Oct13 1453 by 305		
	0.05 mg/l	98.9	85.0-115	0.627	20.0	S35545	07Oct13 1400 by 305	07Oct13 1615 by 305		
Potassium	5 mg/l	96.8	85.0-115			S35522	02Oct13 1400 by 305	03Oct13 1357 by 305		
	5 mg/l	102	85.0-115	5.52	20.0	S35522	02Oct13 1400 by 305	03Oct13 1501 by 305		
Sodium	5 mg/l	97.0	85.0-115			S35522	02Oct13 1400 by 305	03Oct13 1357 by 305		
	5 mg/l	102	85.0-115	4.92	20.0	S35522	02Oct13 1400 by 305	03Oct13 1501 by 305		
Zinc	0.05 mg/l	98.4	85.0-115			S35522	02Oct13 1400 by 305	03Oct13 1357 by 305		
	0.05 mg/l	99.9	85.0-115	1.48	20.0	S35522	02Oct13 1400 by 305	03Oct13 1501 by 305		
Zinc	0.05 mg/l	101	85.0-115			S35527	03Oct13 1400 by 305	03Oct13 1608 by 305		
	0.05 mg/l	99.2	85.0-115	1.71	20.0	S35527	03Oct13 1400 by 305	03Oct13 1724 by 305		
Zinc	0.05 mg/l	101	85.0-115			S35546	07Oct13 1400 by 305	07Oct13 1709 by 305		
	0.05 mg/l	101	85.0-115	0.339	20.0	S35546	07Oct13 1400 by 305	07Oct13 1814 by 305		
Chloride	20 mg/l	92.0	90.0-110			C16081	01Oct13 1108 by 07	01Oct13 1142 by 07		
Chloride	20 mg/l	103	90.0-110			C16086	02Oct13 1443 by 07	02Oct13 1711 by 07		
Sulfate	20 mg/l	92.0	90.0-110			C16081	01Oct13 1108 by 07	01Oct13 1142 by 07		
Sulfate	20 mg/l	103	90.0-110			C16086	02Oct13 1443 by 07	02Oct13 1711 by 07		
Dissolved Organic Carbon	10 mg/l	98.5	85.0-115			W45124	02Oct13 1616 by 308	02Oct13 1758 by 308		
Total Recoverable Copper	0.05 mg/l	98.2	85.0-115			S35522	02Oct13 1400 by 305	03Oct13 1357 by 305		
	0.05 mg/l	97.8	85.0-115	0.402	20.0	S35522	02Oct13 1400 by 305	03Oct13 1501 by 305		
Total Recoverable Zinc	0.05 mg/l	98.4	85.0-115			S35522	02Oct13 1400 by 305	03Oct13 1357 by 305		
	0.05 mg/l	99.9	85.0-115	1.48	20.0	S35522	02Oct13 1400 by 305	03Oct13 1501 by 305		

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MATRIX SPIKE SAMPLE RESULTS

Analyte	Sample	Spike Amount	%	Limits	Batch	Preparation Date	Analysis Date	Dil	Qual
Ammonia as N	171111-1	1 mg/l	-	80.0-120	W45136	03Oct13 0859 by 308	03Oct13 1002 by 308	5	X
	171111-1	1 mg/l	-	80.0-120	W45136	03Oct13 0859 by 308	03Oct13 1050 by 308	26	X
	Relative Percent Difference:		14.5	25.0	W45136				D
Total Organic Carbon	171158-1	10 mg/l	97.9	80.0-120	W45124	02Oct13 1616 by 308	02Oct13 1826 by 308		
	171158-1	10 mg/l	104	80.0-120	W45124	02Oct13 1616 by 308	02Oct13 1840 by 308		
	Relative Percent Difference:		4.55	25.0	W45124				
Chloride	171089-3	20 mg/l	93.4	80.0-120	C16081	01Oct13 1108 by 07	01Oct13 1329 by 07		
	171089-3	20 mg/l	96.3	80.0-120	C16081	01Oct13 1108 by 07	01Oct13 1356 by 07		
	Relative Percent Difference:		2.57	10.0	C16081				
Chloride	171149-1	20 mg/l	97.5	80.0-120	C16086	02Oct13 1443 by 07	02Oct13 1737 by 07		
	171149-1	20 mg/l	97.5	80.0-120	C16086	02Oct13 1443 by 07	02Oct13 1803 by 07		
	Relative Percent Difference:		0.00484	10.0	C16086				
Sulfate	171089-3	20 mg/l	92.1	80.0-120	C16081	01Oct13 1108 by 07	01Oct13 1329 by 07		
	171089-3	20 mg/l	94.4	80.0-120	C16081	01Oct13 1108 by 07	01Oct13 1356 by 07		
	Relative Percent Difference:		2.40	10.0	C16081				
Sulfate	171149-1	20 mg/l	96.7	80.0-120	C16086	02Oct13 1443 by 07	02Oct13 1737 by 07		
	171149-1	20 mg/l	96.4	80.0-120	C16086	02Oct13 1443 by 07	02Oct13 1803 by 07		
	Relative Percent Difference:		0.206	10.0	C16086				

LABORATORY BLANK RESULTS

Analyte	Result	RL	PQL	QC Sample	Preparation Date	Analysis Date	Qual
Alkalinity as CaCO3	< 1 mg/l	1	1	W45122-1		02Oct13 1510 by 93	
Ammonia as N	< 0.1 mg/l	0.1	0.1	W45136-1	03Oct13 0859 by 308	03Oct13 0957 by 308	
Carbonaceous BOD 5-day	< 2 mg/l	2	2	W45114-1	02Oct13 0808 by 285	07Oct13 1122 by 285	
Carbonaceous BOD 5-day	< 2 mg/l	2	2	W45132-1	03Oct13 0810 by 285	08Oct13 0843 by 285	
Total Organic Carbon	< 1 mg/l	1	1	W45124-1	02Oct13 1616 by 308	02Oct13 1743 by 308	
Total Suspended Solids	< 4 mg/l	4	4	W45147-1	03Oct13 1607 by 285	04Oct13 1151 by 285	
Copper	< 0.006 mg/l	0.006	0.006	S35522-1	02Oct13 1400 by 305	03Oct13 1323 by 305	
Copper	< 0.001 mg/l	0.001	0.001	S35522-1	02Oct13 1400 by 305	03Oct13 1323 by 305	
Potassium	< 1 mg/l	1	1	S35522-1	02Oct13 1400 by 305	03Oct13 1323 by 305	
Sodium	< 1 mg/l	1	1	S35522-1	02Oct13 1400 by 305	03Oct13 1323 by 305	
Zinc	< 0.002 mg/l	0.002	0.002	S35522-1	02Oct13 1400 by 305	03Oct13 1323 by 305	
Zinc	< 0.002 mg/l	0.002	0.002	S35527-1	03Oct13 1400 by 305	03Oct13 1456 by 305	
Copper	< 0.006 mg/l	0.006	0.006	S35545-1	07Oct13 1400 by 305	07Oct13 1440 by 305	
Copper	< 0.001 mg/l	0.001	0.001	S35545-1	07Oct13 1400 by 305	07Oct13 1440 by 305	
Zinc	< 0.002 mg/l	0.002	0.002	S35546-1	07Oct13 1400 by 305	07Oct13 1610 by 305	
Chloride	< 0.2 mg/l	0.2	0.2	C16081-1	01Oct13 1108 by 07	01Oct13 1115 by 07	
Sulfate	< 0.2 mg/l	0.2	0.2	C16081-1	01Oct13 1108 by 07	01Oct13 1115 by 07	
Chloride	< 0.2 mg/l	0.2	0.2	C16086-1	02Oct13 1443 by 07	02Oct13 1645 by 07	
Sulfate	< 0.2 mg/l	0.2	0.2	C16086-1	02Oct13 1443 by 07	02Oct13 1645 by 07	
Dissolved Organic Carbon	< 1 mg/l	1	1	W45124-1	02Oct13 1616 by 308	02Oct13 1743 by 308	
Total Recoverable Copper	< 0.001 mg/l	0.001	0.001	S35522-1	02Oct13 1400 by 305	03Oct13 1323 by 305	
Total Recoverable Zinc	< 0.002 mg/l	0.002	0.002	S35522-1	02Oct13 1400 by 305	03Oct13 1323 by 305	

Van Buren C. dubia

Copper WER Study

Stock- 40ppm Cu from $CuSO4*5H20$

1. Weigh 0.0156g and dilute to 100ml.
2. Confirm concentration by ICP.

The Range Finding Test is a 48hr Non Renewal utilizing C. dubia. Five (5) replicates with five (5) C. dubia per cup (5X5). The fifth replicate will be used for a chemistry control

The Control will be unspiked Effluent for the Finding Test and Mod-Hard Water for the Synthetic Water Range Finding Test.

Measure DO and pH at the beginning, 24hrs and end of the test. The 24hr measurement is to be made from the chemistry control. The chemistry control must contain C.dubia.

Effluent sample (100% effluent)

Effluent spiking:

1. 250ppb-Pipet 2.5ml of stock Copper solution and dilute to **400ml** with effluent.
2. 150ppb- Dilute 240ml of 250ppb solution to 400ml with unspiked effluent.
3. 90ppb-Dilute 240ml of 150ppb solution to 400ml with unspiked effluent.
4. 54ppb-Dilute 240ml of 90ppb solution to 400ml with unspiked effluent.
5. 32.4ppb-Dilute 240ml of 54ppb solution to 400ml with unspiked effluent.
6. 19.4ppb-Dilute 240ml of 32.4ppb solution to 400ml with unspiked effluent.

Synthetic MOD Water spiking:

1. 50ppb-Pipet 0.5ml of stock and dilute to **400ml** with Mod Water.
2. 30ppb-Dilute 240ml of 50ppb solution to 400ml with Mod water.
3. 18ppb-Dilute 240ml of 30ppb solution to 400ml with Mod water.
4. 10.8ppb-Dilute 240ml of 18ppb solution to 400ml with Mod water.
5. 6.48ppb-Dilute 240ml of 10.8ppb solution to 400ml with Mod water.
6. 3.89ppb-Dilute 240ml of 6.48ppb solution to 400ml with Mod water.

After preparation, wait at least one hour prior to addition of C. dubia. Submit the remaining spiked effluent solutions to SPC for analysis of Total and Dissolved Copper. (This must be done the same day the test begins).

At test completion, save at least 50ml of each test solution for possible Total and Dissolved Copper analysis. This determination will be made after review of the toxicity results.

Van Buren C.dubia

Zinc WER Study

Stock- 300ppm Zn from ZnSO4*nH20

1. Weigh 0.2429 and dilute to 100ml.
2. Analyze by ICP; evaluate concentration and dilute to make 300ppmZn.

Working Standard 30 ppm:
Dilute 5mls of stock Zn stock to 50ml with lab water.
Verify working standard concentration.

The WER Test is a 48hr Non Renewal utilizing C. dubia four (4) replicates with five (5) per cup (4X5).

The Control will be unspiked Effluent for the effluent test and Mod-Hard Water for the Synthetic Water Range Finding Test.

Measure DO and pH at the beginning, 24hrs and end of the test. The 24hr measurement is to be made from a surrogate container. The surrogate solutions must contain C.dubia

Effluent sample (100% effluent)

Effluent spiking:

1. 250ppb-Pipet 2.5ml of working Zinc Std and dilute to **300ml with effluent.**
2. 150ppb- Dilute 180ml of 250ppb solution to 300ml with unspiked effluent.
3. 90ppb-Dilute 180ml of 150ppb solution to 300ml with unspiked effluent.
4. 54ppb-Dilute 180ml of 90ppb solution to 300ml with unspiked effluent.
5. 32.4ppb-Dilute 180ml of 54ppb solution to 300ml with unspiked effluent.
6. 19.4ppb-Dilute 180ml of 32.4ppb solution to 300ml with unspiked effluent.

Synthetic MOD Water spiking:

1. 250ppb-Pipet 2.5ml of working Zinc Std and dilute to **300ml with Mod. Water.**
2. 150ppb- Dilute 180ml of 250ppb solution to 300ml with Mod water.
3. 90ppb-Dilute 180ml of 150ppb solution to 300ml with Mod water.
4. 54ppb-Dilute 180ml of 90ppb solution to 300ml with Mod water.
5. 32.4ppb-Dilute 180ml of 54ppb solution to 300ml with Mod water.
6. 19.4ppb-Dilute 180ml of 32.4ppb solution to 300ml with Mod water.

After preparation, wait at least one hour prior to addition of C. dubia. Submit the remaining spiked solutions to SPC for analysis of Total and Dissolved Zinc. This must be done the same day the test begins.
At test completion, retain at least 50ml of each test solution for possible Total and Dissolved Zinc analysis. This determination will be made after review of the toxicity results.

APPENDIX G

Laboratory Reports for Zinc WER Testing

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

This report contains the analytical results and supporting information for samples submitted on October 1, 2013. Attached please find a copy of the Chain of Custody and/or other documents received. Note that any remaining sample will be discarded two weeks from the original report date unless other arrangements are made.

This report is intended for the sole use of the client listed above. Assessment of the data requires access to the entire document.

This report has been reviewed by the Laboratory Director or a qualified designee.

John Overbey
Laboratory Director

This document has been distributed to the following:

PDF cc: FTN Associates, Ltd.
ATTN: Mr. Pat Downey
pjd@ftn-assoc.com

Van Buren Municipal Utilities
ATTN: Mr. Clyde Hill
vbfred@aol.com

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

SAMPLE INFORMATION

Project Description:
Two (2) water sample(s) received on October 1, 2013
North Plant

Receipt Details:
A Chain of Custody was not provided. The samples were delivered in one (1) ice chest.

Each sample container was checked for proper labeling, including date and time sampled. Sample containers were reviewed for proper type, adequate volume, integrity, temperature, preservation, and holding times. Any exceptions are noted below:

Sample Identification:

Laboratory ID	Client Sample ID	Sampled Date/Time	Notes
171106-1	NPE 1 9/29-30/13 8:00-8:15am	30-Sep-2013 0815	
171106-2	MOD Water		
171106-3	Effluent 250ppb Cu Initial		
171106-4	Effluent 150ppb Cu Initial		
171106-5	Effluent 90ppb Cu Initial		
171106-6	Effluent 54ppb Cu Initial		
171106-7	Effluent 32.4ppb Cu Initial		
171106-8	Effluent 19.4ppb Cu Initial		
171106-9	Synthetic MOD 50ppb Cu Initial		
171106-10	Synthetic MOD 30ppb Cu Initial		
171106-11	Synthetic MOD 18ppb Cu Initial		
171106-12	Synthetic MOD 10.8ppb Cu Initial		
171106-13	Synthetic MOD 6.48ppb Cu Initial		
171106-14	Synthetic MOD 3.89ppb Cu Initial		
171106-15	Effluent 250ppb Cu Final		
171106-16	Effluent 150ppb Cu Final		
171106-17	Effluent 90ppb Cu Final		
171106-18	Effluent 54ppb Cu Final		
171106-19	Effluent 32.4ppb Cu Final		
171106-20	Effluent 19.4ppb Cu Final		
171106-21	Synthetic MOD 50ppb Cu Final		
171106-22	Synthetic MOD 30ppb Cu Final		
171106-23	Synthetic MOD 18ppb Cu Final		
171106-24	Synthetic MOD 10.8ppb Cu Final		
171106-25	Synthetic MOD 6.48ppb Cu Final		
171106-26	Synthetic MOD 3.89ppb Cu Final		
171106-27	Effluent 250ppb Zn Initial		
171106-28	Effluent 150ppb Zn Initial		
171106-29	Effluent 90ppb Zn Initial		
171106-30	Effluent 54ppb Zn Initial		
171106-31	Effluent 32.4ppb Zn Initial		
171106-32	Effluent 19.4ppb Zn Initial		
171106-33	Synthetic MOD 250ppb Zn Initial		
171106-34	Synthetic MOD 150ppb Zn Initial		
171106-35	Synthetic MOD 90ppb Zn Initial		
171106-36	Synthetic MOD 54ppb Zn Initial		
171106-37	Synthetic MOD 32.4ppb Zn Initial		

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SAMPLE INFORMATION

Laboratory ID	Client Sample ID	Sampled Date/Time	Notes
171106-38	Synthetic MOD 19.4ppb Zn Initial		
171106-39	Effluent 250ppb Zn Final		
171106-40	Effluent 150ppb Zn Final		
171106-41	Effluent 90ppb Zn Final		
171106-42	Effluent 54ppb Zn Final		
171106-43	Effluent 32.4ppb Zn Final		
171106-44	Effluent 19.4ppb Zn Final		
171106-45	Synthetic MOD 250ppb Zn Final		
171106-46	Synthetic MOD 150ppb Zn Final		
171106-47	Synthetic MOD 90ppb Zn Final		
171106-48	Synthetic MOD 54ppb Zn Final		
171106-49	Synthetic MOD 32.4ppb Zn Final		
171106-50	Synthetic MOD 19.4ppb Zn Final		

Qualifiers:

D Result is from a secondary dilution factor
H Analytical holding time exceeded regulatory requirements
X Spiking level is invalid due to the high concentration of analyte in the spiked sample

Case Narrative:

Table II of 40 CFR Part 136.3 indicates analysis of pH, Total Residual Chlorine, and Dissolved Oxygen are to be performed on site or immediately after collection. American Interplex Corporation analyzes these parameters as soon as possible after laboratory receipt.

References:

"Methods for Chemical Analysis of Water and Wastes", EPA/600/4-79-020 (Mar 1983) with updates and supplements EPA/600/5-91-010 (Jun 1991), EPA/600/R-92-129 (Aug 1992) and EPA/600/R-93-100 (Aug 1993).
"Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846)", Third Edition.
"Standard Methods for the Examination of Water and Wastewaters", 21st edition.
"American Society for Testing and Materials" (ASTM).
"Association of Analytical Chemists" (AOAC).

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ANALYTICAL RESULTS

AIC No. 171106-1
Sample Identification: NPE 1 9/29-30/13 8:00-8:15am

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3 SM 2320 B		**23** Analyzed: 02-Oct-2013 1510 by 93	1	**mg/l** Batch: W45122	
pH SM 4500-H+ B		**7.4** Analyzed: 01-Oct-2013 1709 by 93		**Units** Batch: W45107	H
Ammonia as N SM 4500-NH3 G	Prep: 03-Oct-2013 0858 by 308	**0.21** Analyzed: 03-Oct-2013 1018 by 308	0.1	**mg/l** Batch: W45136	
Carbonaceous BOD 5-day SM 5210 B	Prep: 02-Oct-2013 0808 by 285	**< 2** Analyzed: 07-Oct-2013 1134 by 285	2	**mg/l** Batch: W45114	
Total Organic Carbon SM 5310 C	Prep: 02-Oct-2013 1615 by 308	**6.7** Analyzed: 02-Oct-2013 2034 by 308	1	**mg/l** Batch: W45124	
Total Suspended Solids USGS 3765	Prep: 03-Oct-2013 1607 by 285	**< 4** Analyzed: 04-Oct-2013 1151 by 285	4	**mg/l** Batch: W45147	
Potassium EPA 200.8	Prep: 02-Oct-2013 1400 by 305	**11** Analyzed: 04-Oct-2013 1411 by 305	1	**mg/l** Batch: S35522	
Sodium EPA 200.8	Prep: 02-Oct-2013 1400 by 305	**37** Analyzed: 04-Oct-2013 1411 by 305	1	**mg/l** Batch: S35522	
Hardness as CaCO3 SM 2340 B	Prep: 02-Oct-2013 1400 by 305	**70** Analyzed: 04-Oct-2013 1411 by 305	1	**mg/l** Batch: S35522	
Chloride EPA 300.0	Prep: 01-Oct-2013 1747 by 07	**36** Analyzed: 01-Oct-2013 2045 by 07	0.2	**mg/l** Batch: C16081	
Sulfate EPA 300.0	Prep: 01-Oct-2013 1747 by 07	**20** Analyzed: 01-Oct-2013 2045 by 07	0.2	**mg/l** Batch: C16081	
Dissolved Organic Carbon SM 5310 C	Prep: 02-Oct-2013 1616 by 308	**5.7** Analyzed: 02-Oct-2013 2102 by 308	1	**mg/l** Batch: W45124	
Dissolved Copper EPA 200.8	Prep: 02-Oct-2013 1400 by 305	**9.47** Analyzed: 04-Oct-2013 1405 by 305	1	**ug/l** Batch: S35522	
Dissolved Zinc EPA 200.8	Prep: 02-Oct-2013 1400 by 305	**61.1** Analyzed: 04-Oct-2013 1405 by 305	2	**ug/l** Batch: S35522	
Total Recoverable Copper EPA 200.8	Prep: 02-Oct-2013 1400 by 305	**11.2** Analyzed: 04-Oct-2013 1411 by 305	1	**ug/l** Batch: S35522	
Total Recoverable Zinc EPA 200.8	Prep: 02-Oct-2013 1400 by 305	**64.9** Analyzed: 04-Oct-2013 1411 by 305	2	**ug/l** Batch: S35522	

AIC No. 171106-2
Sample Identification: MOD Water

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3 SM 2320 B		**64** Analyzed: 02-Oct-2013 1510 by 93	1	**mg/l** Batch: W45122	
pH SM 4500-H+ B		**8.1** Analyzed: 02-Oct-2013 1818 by 93		**Units** Batch: W45128	

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ANALYTICAL RESULTS

AIC No. 171106-2 (Continued)
Sample Identification: MOD Water

Analyte		Result	RL	Units	Qualifier
Ammonia as N		**< 0.1**	0.1	**mg/l**	
SM 4500-NH3 G	Prep: 03-Oct-2013 0858 by 308	Analyzed: 03-Oct-2013 1020 by 308		Batch: W45136	
Carbonaceous BOD 5-day		**< 2**	2	**mg/l**	
SM 5210 B	Prep: 03-Oct-2013 0810 by 285	Analyzed: 08-Oct-2013 0925 by 308		Batch: W45132	
Total Organic Carbon		**< 1**	1	**mg/l**	
SM 5310 C	Prep: 02-Oct-2013 1615 by 308	Analyzed: 02-Oct-2013 2048 by 308		Batch: W45124	
Total Suspended Solids		**< 4**	4	**mg/l**	
USGS 3765	Prep: 03-Oct-2013 1607 by 285	Analyzed: 04-Oct-2013 1151 by 285		Batch: W45147	
Potassium		**1.8**	1	**mg/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 02-Oct-2013 1623 by 305		Batch: S35522	
Sodium		**25**	1	**mg/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 02-Oct-2013 1623 by 305		Batch: S35522	
Hardness as CaCO3		**81**	1	**mg/l**	
SM 2340 B	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1200 by 305		Batch: S35522	
Chloride		**1.9**	0.2	**mg/l**	
EPA 300.0	Prep: 02-Oct-2013 1443 by 07	Analyzed: 02-Oct-2013 2012 by 07		Batch: C16086	
Sulfate		**85**	2	**mg/l**	D
EPA 300.0	Prep: 02-Oct-2013 1443 by 07	Analyzed: 02-Oct-2013 1946 by 07		Batch: C16086	Dil: 10
Dissolved Organic Carbon		**< 1**	1	**mg/l**	
SM 5310 C	Prep: 02-Oct-2013 1616 by 308	Analyzed: 03-Oct-2013 0944 by 308		Batch: W45124	
Dissolved Copper		**< 1**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 02-Oct-2013 1725 by 305		Batch: S35522	
Dissolved Zinc		**< 2**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 02-Oct-2013 1725 by 305		Batch: S35522	
Total Recoverable Copper		**< 1**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 02-Oct-2013 1623 by 305		Batch: S35522	
Total Recoverable Zinc		**< 2**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 02-Oct-2013 1623 by 305		Batch: S35522	

AIC No. 171106-3
Sample Identification: Effluent 250ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**233**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1526 by 305		Batch: S35522	
Dissolved Copper		**217**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1521 by 305		Batch: S35522	

AIC No. 171106-4
Sample Identification: Effluent 150ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**146**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1515 by 305		Batch: S35522	

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ANALYTICAL RESULTS

AIC No. 171106-4 (Continued)
Sample Identification: Effluent 150ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Copper		**126**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1510 by 305		Batch: S35522	

AIC No. 171106-5
Sample Identification: Effluent 90ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**91.8**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1454 by 305		Batch: S35522	
Dissolved Copper		**82.3**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1448 by 305		Batch: S35522	

AIC No. 171106-6
Sample Identification: Effluent 54ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**62.2**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1443 by 305		Batch: S35522	
Dissolved Copper		**47.0**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1438 by 305		Batch: S35522	

AIC No. 171106-7
Sample Identification: Effluent 32.4ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**43.9**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1432 by 305		Batch: S35522	
Dissolved Copper		**39.8**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1427 by 305		Batch: S35522	

AIC No. 171106-8
Sample Identification: Effluent 19.4ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**28.5**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1422 by 305		Batch: S35522	
Dissolved Copper		**25.4**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1416 by 305		Batch: S35522	

AIC No. 171106-9
Sample Identification: Synthetic MOD 50ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**48.4**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 02-Oct-2013 1649 by 305		Batch: S35522	

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ANALYTICAL RESULTS

AIC No. 171106-9 (Continued)
Sample Identification: Synthetic MOD 50ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Copper		**48.4**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 02-Oct-2013 1747 by 305		Batch: S35522	

AIC No. 171106-10
Sample Identification: Synthetic MOD 30ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**29.6**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1713 by 305		Batch: S35522	
Dissolved Copper		**29.6**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1708 by 305		Batch: S35522	

AIC No. 171106-11
Sample Identification: Synthetic MOD 18ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**18.2**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1702 by 305		Batch: S35522	
Dissolved Copper		**17**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1645 by 305		Batch: S35522	

AIC No. 171106-12
Sample Identification: Synthetic MOD 10.8ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**10.2**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1640 by 305		Batch: S35522	
Dissolved Copper		**9.17**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1634 by 305		Batch: S35522	

AIC No. 171106-13
Sample Identification: Synthetic MOD 6.48ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**5.70**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1629 by 305		Batch: S35522	
Dissolved Copper		**4.80**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1624 by 305		Batch: S35522	

AIC No. 171106-14
Sample Identification: Synthetic MOD 3.89ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Copper		**3.00**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1618 by 305		Batch: S35522	

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ANALYTICAL RESULTS

AIC No. 171106-14 (Continued)
Sample Identification: Synthetic MOD 3.89ppb Cu Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Copper		**2.80**	1	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1613 by 305		Batch: S35522	

AIC No. 171106-15
Sample Identification: Effluent 250ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**222**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2106 by 305		Batch: S35545	
Dissolved Copper		**189**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2101 by 305		Batch: S35545	

AIC No. 171106-16
Sample Identification: Effluent 150ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**136**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2055 by 305		Batch: S35545	
Dissolved Copper		**126**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2050 by 305		Batch: S35545	

AIC No. 171106-17
Sample Identification: Effluent 90ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**85.6**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2045 by 305		Batch: S35545	
Dissolved Copper		**77.3**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2039 by 305		Batch: S35545	

AIC No. 171106-18
Sample Identification: Effluent 54ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**54.3**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2034 by 305		Batch: S35545	
Dissolved Copper		**48.0**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2028 by 305		Batch: S35545	

AIC No. 171106-19
Sample Identification: Effluent 32.4ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**37.4**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2012 by 305		Batch: S35545	

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ANALYTICAL RESULTS

AIC No. 171106-19 (Continued)
Sample Identification: Effluent 32.4ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Dissolved Copper		**32.7**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2007 by 305		Batch: S35545	

AIC No. 171106-20
Sample Identification: Effluent 19.4ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**25.4**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2002 by 305		Batch: S35545	
Dissolved Copper		**24.2**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1956 by 305		Batch: S35545	

AIC No. 171106-21
Sample Identification: Synthetic MOD 50ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**45.9**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1951 by 305		Batch: S35545	
Dissolved Copper		**44.0**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1946 by 305		Batch: S35545	

AIC No. 171106-22
Sample Identification: Synthetic MOD 30ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**25.9**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1940 by 305		Batch: S35545	
Dissolved Copper		**23.5**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1935 by 305		Batch: S35545	

AIC No. 171106-23
Sample Identification: Synthetic MOD 18ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**15.7**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1929 by 305		Batch: S35545	
Dissolved Copper		**12.7**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1924 by 305		Batch: S35545	

AIC No. 171106-24
Sample Identification: Synthetic MOD 10.8ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**8.46**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1908 by 305		Batch: S35545	

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ANALYTICAL RESULTS

AIC No. 171106-24 (Continued)
Sample Identification: Synthetic MOD 10.8ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Dissolved Copper		**6.91**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1903 by 305		Batch: S35545	

AIC No. 171106-25
Sample Identification: Synthetic MOD 6.48ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**5.12**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1857 by 305		Batch: S35545	
Dissolved Copper		**3.96**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1852 by 305		Batch: S35545	

AIC No. 171106-26
Sample Identification: Synthetic MOD 3.89ppb Cu Final

Analyte		Result	RL	Units	Qualifier
Copper		**2.61**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1846 by 305		Batch: S35545	
Dissolved Copper		**2.03**	1	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1841 by 305		Batch: S35545	

AIC No. 171106-27
Sample Identification: Effluent 250ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**236**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1636 by 305		Batch: S35522	
Dissolved Zinc		**236**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1648 by 305		Batch: S35522	

AIC No. 171106-28
Sample Identification: Effluent 150ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**169**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1630 by 305		Batch: S35522	
Dissolved Zinc		**160**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1625 by 305		Batch: S35522	

AIC No. 171106-29
Sample Identification: Effluent 90ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**132**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1620 by 305		Batch: S35522	

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ANALYTICAL RESULTS

AIC No. 171106-29 (Continued)
Sample Identification: Effluent 90ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**125**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1614 by 305		Batch: S35522	

AIC No. 171106-30
Sample Identification: Effluent 54ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**101**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1558 by 305		Batch: S35522	
Dissolved Zinc		**98.7**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1553 by 305		Batch: S35522	

AIC No. 171106-31
Sample Identification: Effluent 32.4ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**90.6**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1547 by 305		Batch: S35522	
Dissolved Zinc		**88.8**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1542 by 305		Batch: S35522	

AIC No. 171106-32
Sample Identification: Effluent 19.4ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**76.6**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1531 by 305		Batch: S35522	
Dissolved Zinc		**75.5**	2	**ug/l**	
EPA 200.8	Prep: 02-Oct-2013 1400 by 305	Analyzed: 04-Oct-2013 1537 by 305		Batch: S35522	

AIC No. 171106-33
Sample Identification: Synthetic MOD 250ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**237**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1938 by 305		Batch: S35527	
Dissolved Zinc		**222**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1944 by 305		Batch: S35527	

AIC No. 171106-34
Sample Identification: Synthetic MOD 150ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**138**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1922 by 305		Batch: S35527	

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ANALYTICAL RESULTS

AIC No. 171106-34 (Continued)
Sample Identification: Synthetic MOD 150ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**138**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 1559 by 305		Batch: S35527	

AIC No. 171106-35
Sample Identification: Synthetic MOD 90ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**90.8**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1911 by 305		Batch: S35527	
Dissolved Zinc		**86.5**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1906 by 305		Batch: S35527	

AIC No. 171106-36
Sample Identification: Synthetic MOD 54ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**50.4**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1855 by 305		Batch: S35527	
Dissolved Zinc		**47.2**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1901 by 305		Batch: S35527	

AIC No. 171106-37
Sample Identification: Synthetic MOD 32.4ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**34.3**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1845 by 305		Batch: S35527	
Dissolved Zinc		**34.0**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1850 by 305		Batch: S35527	

AIC No. 171106-38
Sample Identification: Synthetic MOD 19.4ppb Zn Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**19.3**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1834 by 305		Batch: S35527	
Dissolved Zinc		**18.7**	2	**ug/l**	
EPA 200.8	Prep: 03-Oct-2013 1400 by 305	Analyzed: 03-Oct-2013 1839 by 305		Batch: S35527	

AIC No. 171106-39
Sample Identification: Effluent 250ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**263**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 14-Oct-2013 1945 by 305		Batch: S35546	

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ANALYTICAL RESULTS

AIC No. 171106-39 (Continued)
Sample Identification: Effluent 250ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**213**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 14-Oct-2013 1939 by 305		Batch: S35546	

AIC No. 171106-40
Sample Identification: Effluent 150ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**172**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1607 by 305		Batch: S35546	
Dissolved Zinc		**154**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1601 by 305		Batch: S35546	

AIC No. 171106-41
Sample Identification: Effluent 90ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**137**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1556 by 305		Batch: S35546	
Dissolved Zinc		**122**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1551 by 305		Batch: S35546	

AIC No. 171106-42
Sample Identification: Effluent 54ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**96.0**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1545 by 305		Batch: S35546	
Dissolved Zinc		**96.9**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1540 by 305		Batch: S35546	

AIC No. 171106-43
Sample Identification: Effluent 32.4ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**81.4**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1535 by 305		Batch: S35546	
Dissolved Zinc		**81.0**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1529 by 305		Batch: S35546	

AIC No. 171106-44
Sample Identification: Effluent 19.4ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**78.3**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 14-Oct-2013 1934 by 305		Batch: S35546	

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ANALYTICAL RESULTS

AIC No. 171106-44 (Continued)
Sample Identification: Effluent 19.4ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**69.7**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 14-Oct-2013 1929 by 305		Batch: S35546	

AIC No. 171106-45
Sample Identification: Synthetic MOD 250ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**225**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1458 by 305		Batch: S35546	
Dissolved Zinc		**211**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1453 by 305		Batch: S35546	

AIC No. 171106-46
Sample Identification: Synthetic MOD 150ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**132**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1447 by 305		Batch: S35546	
Dissolved Zinc		**125**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1442 by 305		Batch: S35546	

AIC No. 171106-47
Sample Identification: Synthetic MOD 90ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**89.1**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1437 by 305		Batch: S35546	
Dissolved Zinc		**84.4**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1431 by 305		Batch: S35546	

AIC No. 171106-48
Sample Identification: Synthetic MOD 54ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**52.0**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1426 by 305		Batch: S35546	
Dissolved Zinc		**46.5**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1420 by 305		Batch: S35546	

AIC No. 171106-49
Sample Identification: Synthetic MOD 32.4ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**34.0**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1415 by 305		Batch: S35546	

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ANALYTICAL RESULTS

AIC No. 171106-49 (Continued)
Sample Identification: Synthetic MOD 32.4ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**33.0**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 08-Oct-2013 1410 by 305		Batch: S35546	

AIC No. 171106-50
Sample Identification: Synthetic MOD 19.4ppb Zn Final

Analyte		Result	RL	Units	Qualifier
Zinc		**22.9**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2117 by 305		Batch: S35546	
Dissolved Zinc		**20.2**	2	**ug/l**	
EPA 200.8	Prep: 07-Oct-2013 1400 by 305	Analyzed: 07-Oct-2013 2111 by 305		Batch: S35546	

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DUPLICATE RESULTS

Analyte		AIC No.	Result	RPD	RPD Limit	Preparation Date	Analysis Date	Dil	Qual
pH		171094-1	7.3 Units				01Oct13 1057 by 93		H
	Batch: W45107	Duplicate	7.3 Units	0.274	5.00		01Oct13 1058 by 93		H
Carbonaceous BOD 5-day		171073-1	< 2 mg/l			02Oct13 0808 by 285	07Oct13 1124 by 285		
	Batch: W45114	Duplicate	< 2 mg/l	0.00	20.0	02Oct13 0808 by 285	07Oct13 1126 by 285		
Alkalinity as CaCO3		171106-2	64 mg/l				02Oct13 1510 by 93		
	Batch: W45122	Duplicate	63 mg/l	1.42	20.0		02Oct13 1510 by 93		
pH		171106-2	8.1 Units				02Oct13 1818 by 93		
	Batch: W45128	Duplicate	8.1 Units	0.00	5.00		02Oct13 1819 by 93		
Carbonaceous BOD 5-day		171154-1	< 2 mg/l			03Oct13 0810 by 285	08Oct13 0846 by 285		
	Batch: W45132	Duplicate	< 2 mg/l	0.00	20.0	03Oct13 0810 by 285	08Oct13 0848 by 285		
Total Suspended Solids		171106-1	< 4 mg/l			03Oct13 1607 by 285	04Oct13 1151 by 285		
	Batch: W45147	Duplicate	< 4 mg/l	0.00	20.0	03Oct13 1607 by 285	04Oct13 1151 by 285		
Total Suspended Solids		171106-2	< 4 mg/l			03Oct13 1607 by 285	04Oct13 1151 by 285		
	Batch: W45147	Duplicate	< 4 mg/l	0.00	20.0	03Oct13 1607 by 285	04Oct13 1151 by 285		

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LABORATORY CONTROL SAMPLE RESULTS

Analyte	Spike Amount	%	Limits	RPD	Limit	Batch	Preparation Date	Analysis Date	Dil	Qual
pH	-	100	98.0-102			W45107		01Oct13 1058 by 93		
pH	-	100	98.0-102			W45128		02Oct13 1819 by 93		
Ammonia as N	1 mg/l	92.3	80.0-120			W45136	03Oct13 0859 by 308	03Oct13 0959 by 308		
Carbonaceous BOD 5-day	200 mg/l	104	84.5-115			W45114	02Oct13 0808 by 285	07Oct13 1123 by 285		
Carbonaceous BOD 5-day	200 mg/l	107	84.5-115			W45132	03Oct13 0810 by 285	08Oct13 0844 by 285		
Total Organic Carbon	10 mg/l	98.5	80.0-120			W45124	02Oct13 1616 by 308	02Oct13 1758 by 308		
Copper	0.05 mg/l	98.2	85.0-115			S35522	02Oct13 1400 by 305	03Oct13 1357 by 305		
	0.05 mg/l	97.8	85.0-115	0.402	20.0	S35522	02Oct13 1400 by 305	03Oct13 1501 by 305		
Copper	0.05 mg/l	99.5	85.0-115			S35545	07Oct13 1400 by 305	07Oct13 1453 by 305		
	0.05 mg/l	98.9	85.0-115	0.627	20.0	S35545	07Oct13 1400 by 305	07Oct13 1615 by 305		
Potassium	5 mg/l	96.8	85.0-115			S35522	02Oct13 1400 by 305	03Oct13 1357 by 305		
	5 mg/l	102	85.0-115	5.52	20.0	S35522	02Oct13 1400 by 305	03Oct13 1501 by 305		
Sodium	5 mg/l	97.0	85.0-115			S35522	02Oct13 1400 by 305	03Oct13 1357 by 305		
	5 mg/l	102	85.0-115	4.92	20.0	S35522	02Oct13 1400 by 305	03Oct13 1501 by 305		
Zinc	0.05 mg/l	98.4	85.0-115			S35522	02Oct13 1400 by 305	03Oct13 1357 by 305		
	0.05 mg/l	99.9	85.0-115	1.48	20.0	S35522	02Oct13 1400 by 305	03Oct13 1501 by 305		
Zinc	0.05 mg/l	101	85.0-115			S35527	03Oct13 1400 by 305	03Oct13 1608 by 305		
	0.05 mg/l	99.2	85.0-115	1.71	20.0	S35527	03Oct13 1400 by 305	03Oct13 1724 by 305		
Zinc	0.05 mg/l	101	85.0-115			S35546	07Oct13 1400 by 305	07Oct13 1709 by 305		
	0.05 mg/l	101	85.0-115	0.339	20.0	S35546	07Oct13 1400 by 305	07Oct13 1814 by 305		
Chloride	20 mg/l	92.0	90.0-110			C16081	01Oct13 1108 by 07	01Oct13 1142 by 07		
Chloride	20 mg/l	103	90.0-110			C16086	02Oct13 1443 by 07	02Oct13 1711 by 07		
Sulfate	20 mg/l	92.0	90.0-110			C16081	01Oct13 1108 by 07	01Oct13 1142 by 07		
Sulfate	20 mg/l	103	90.0-110			C16086	02Oct13 1443 by 07	02Oct13 1711 by 07		
Dissolved Organic Carbon	10 mg/l	98.5	85.0-115			W45124	02Oct13 1616 by 308	02Oct13 1758 by 308		
Total Recoverable Copper	0.05 mg/l	98.2	85.0-115			S35522	02Oct13 1400 by 305	03Oct13 1357 by 305		
	0.05 mg/l	97.8	85.0-115	0.402	20.0	S35522	02Oct13 1400 by 305	03Oct13 1501 by 305		
Total Recoverable Zinc	0.05 mg/l	98.4	85.0-115			S35522	02Oct13 1400 by 305	03Oct13 1357 by 305		
	0.05 mg/l	99.9	85.0-115	1.48	20.0	S35522	02Oct13 1400 by 305	03Oct13 1501 by 305		

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MATRIX SPIKE SAMPLE RESULTS

Analyte	Sample	Spike Amount	%	Limits	Batch	Preparation Date	Analysis Date	Dil	Qual
Ammonia as N	171111-1	1 mg/l	-	80.0-120	W45136	03Oct13 0859 by 308	03Oct13 1002 by 308	5	X
	171111-1	1 mg/l	-	80.0-120	W45136	03Oct13 0859 by 308	03Oct13 1050 by 308	26	X
	Relative Percent Difference:		14.5	25.0	W45136				D
Total Organic Carbon	171158-1	10 mg/l	97.9	80.0-120	W45124	02Oct13 1616 by 308	02Oct13 1826 by 308		
	171158-1	10 mg/l	104	80.0-120	W45124	02Oct13 1616 by 308	02Oct13 1840 by 308		
	Relative Percent Difference:		4.55	25.0	W45124				
Chloride	171089-3	20 mg/l	93.4	80.0-120	C16081	01Oct13 1108 by 07	01Oct13 1329 by 07		
	171089-3	20 mg/l	96.3	80.0-120	C16081	01Oct13 1108 by 07	01Oct13 1356 by 07		
	Relative Percent Difference:		2.57	10.0	C16081				
Chloride	171149-1	20 mg/l	97.5	80.0-120	C16086	02Oct13 1443 by 07	02Oct13 1737 by 07		
	171149-1	20 mg/l	97.5	80.0-120	C16086	02Oct13 1443 by 07	02Oct13 1803 by 07		
	Relative Percent Difference:		0.00484	10.0	C16086				
Sulfate	171089-3	20 mg/l	92.1	80.0-120	C16081	01Oct13 1108 by 07	01Oct13 1329 by 07		
	171089-3	20 mg/l	94.4	80.0-120	C16081	01Oct13 1108 by 07	01Oct13 1356 by 07		
	Relative Percent Difference:		2.40	10.0	C16081				
Sulfate	171149-1	20 mg/l	96.7	80.0-120	C16086	02Oct13 1443 by 07	02Oct13 1737 by 07		
	171149-1	20 mg/l	96.4	80.0-120	C16086	02Oct13 1443 by 07	02Oct13 1803 by 07		
	Relative Percent Difference:		0.206	10.0	C16086				

LABORATORY BLANK RESULTS

Analyte	Result	RL	PQL	QC Sample	Preparation Date	Analysis Date	Qual
Alkalinity as CaCO3	< 1 mg/l	1	1	W45122-1		02Oct13 1510 by 93	
Ammonia as N	< 0.1 mg/l	0.1	0.1	W45136-1	03Oct13 0859 by 308	03Oct13 0957 by 308	
Carbonaceous BOD 5-day	< 2 mg/l	2	2	W45114-1	02Oct13 0808 by 285	07Oct13 1122 by 285	
Carbonaceous BOD 5-day	< 2 mg/l	2	2	W45132-1	03Oct13 0810 by 285	08Oct13 0843 by 285	
Total Organic Carbon	< 1 mg/l	1	1	W45124-1	02Oct13 1616 by 308	02Oct13 1743 by 308	
Total Suspended Solids	< 4 mg/l	4	4	W45147-1	03Oct13 1607 by 285	04Oct13 1151 by 285	
Copper	< 0.006 mg/l	0.006	0.006	S35522-1	02Oct13 1400 by 305	03Oct13 1323 by 305	
Copper	< 0.001 mg/l	0.001	0.001	S35522-1	02Oct13 1400 by 305	03Oct13 1323 by 305	
Potassium	< 1 mg/l	1	1	S35522-1	02Oct13 1400 by 305	03Oct13 1323 by 305	
Sodium	< 1 mg/l	1	1	S35522-1	02Oct13 1400 by 305	03Oct13 1323 by 305	
Zinc	< 0.002 mg/l	0.002	0.002	S35522-1	02Oct13 1400 by 305	03Oct13 1323 by 305	
Zinc	< 0.002 mg/l	0.002	0.002	S35527-1	03Oct13 1400 by 305	03Oct13 1456 by 305	
Copper	< 0.006 mg/l	0.006	0.006	S35545-1	07Oct13 1400 by 305	07Oct13 1440 by 305	
Copper	< 0.001 mg/l	0.001	0.001	S35545-1	07Oct13 1400 by 305	07Oct13 1440 by 305	
Zinc	< 0.002 mg/l	0.002	0.002	S35546-1	07Oct13 1400 by 305	07Oct13 1610 by 305	
Chloride	< 0.2 mg/l	0.2	0.2	C16081-1	01Oct13 1108 by 07	01Oct13 1115 by 07	
Sulfate	< 0.2 mg/l	0.2	0.2	C16081-1	01Oct13 1108 by 07	01Oct13 1115 by 07	
Chloride	< 0.2 mg/l	0.2	0.2	C16086-1	02Oct13 1443 by 07	02Oct13 1645 by 07	
Sulfate	< 0.2 mg/l	0.2	0.2	C16086-1	02Oct13 1443 by 07	02Oct13 1645 by 07	
Dissolved Organic Carbon	< 1 mg/l	1	1	W45124-1	02Oct13 1616 by 308	02Oct13 1743 by 308	
Total Recoverable Copper	< 0.001 mg/l	0.001	0.001	S35522-1	02Oct13 1400 by 305	03Oct13 1323 by 305	
Total Recoverable Zinc	< 0.002 mg/l	0.002	0.002	S35522-1	02Oct13 1400 by 305	03Oct13 1323 by 305	

Van Buren C. dubia

Copper WER Study

Stock- 40ppm Cu from CuSO4*5H20
1. Weigh 0.0156g and dilute to 100ml.
2. Confirm concentration by ICP.

The Range Finding Test is a 48hr Non Renewal utilizing C. dubia. Five (5) replicates with five (5) C. dubia per cup (5X5). The fifth replicate will be used for a chemistry control

The Control will be unspiked Effluent for the Finding Test and Mod-Hard Water for the Synthetic Water Range Finding Test.

Measure DO and pH at the beginning, 24hrs and end of the test. The 24hr measurement is to be made from the chemistry control. The chemistry control must contain C.dubia.

Effluent sample (100% effluent)

Effluent spiking:
1. 250ppb-Pipet 2.5ml of stock Copper solution and dilute to **400ml** with effluent.
2. 150ppb- Dilute 240ml of 250ppb solution to 400ml with unspiked effluent.
3. 90ppb-Dilute 240ml of 150ppb solution to 400ml with unspiked effluent.
4. 54ppb-Dilute 240ml of 90ppb solution to 400ml with unspiked effluent.
5. 32.4ppb-Dilute 240ml of 54ppb solution to 400ml with unspiked effluent.
6. 19.4ppb-Dilute 240ml of 32.4ppb solution to 400ml with unspiked effluent.

Synthetic MOD Water spiking:
1. 50ppb-Pipet 0.5ml of stock and dilute to **400ml** with Mod Water.
2. 30ppb-Dilute 240ml of 50ppb solution to 400ml with Mod water.
3. 18ppb-Dilute 240ml of 30ppb solution to 400ml with Mod water.
4. 10.8ppb-Dilute 240ml of 18ppb solution to 400ml with Mod water.
5. 6.48ppb-Dilute 240ml of 10.8ppb solution to 400ml with Mod water.
6. 3.89ppb-Dilute 240ml of 6.48ppb solution to 400ml with Mod water.

After preparation, wait at least one hour prior to addition of C. dubia. Submit the remaining spiked effluent solutions to SPC for analysis of Total and Dissolved Copper. (This must be done the same day the test begins).

At test completion, save at least 50ml of each test solution for possible Total and Dissolved Copper analysis. This determination will be made after review of the toxicity results.

Van Buren C.dubia

Zinc WER Study

Stock- 300ppm Zn from ZnSO4*nH20

1. Weigh 0.2429 and dilute to 100ml.
2. Analyze by ICP; evaluate concentration and dilute to make 300ppmZn.

Working Standard 30 ppm:
Dilute 5mls of stock Zn stock to 50ml with lab water.
Verify working standard concentration.

The WER Test is a 48hr Non Renewal utilizing C. dubia four (4) replicates with five (5) per cup (4X5).

The Control will be unspiked Effluent for the effluent test and Mod-Hard Water for the Synthetic Water Range Finding Test.

Measure DO and pH at the beginning, 24hrs and end of the test. The 24hr measurement is to be made from a surrogate container. The surrogate solutions must contain C.dubia

Effluent sample (100% effluent)

Effluent spiking:

1. 250ppb-Pipet 2.5ml of working Zinc Std and dilute to **300ml with effluent.**
2. 150ppb- Dilute 180ml of 250ppb solution to 300ml with unspiked effluent.
3. 90ppb-Dilute 180ml of 150ppb solution to 300ml with unspiked effluent.
4. 54ppb-Dilute 180ml of 90ppb solution to 300ml with unspiked effluent.
5. 32.4ppb-Dilute 180ml of 54ppb solution to 300ml with unspiked effluent.
6. 19.4ppb-Dilute 180ml of 32.4ppb solution to 300ml with unspiked effluent.

Synthetic MOD Water spiking:

1. 250ppb-Pipet 2.5ml of working Zinc Std and dilute to **300ml with Mod. Water.**
2. 150ppb- Dilute 180ml of 250ppb solution to 300ml with Mod water.
3. 90ppb-Dilute 180ml of 150ppb solution to 300ml with Mod water.
4. 54ppb-Dilute 180ml of 90ppb solution to 300ml with Mod water.
5. 32.4ppb-Dilute 180ml of 54ppb solution to 300ml with Mod water.
6. 19.4ppb-Dilute 180ml of 32.4ppb solution to 300ml with Mod water.

After preparation, wait at least one hour prior to addition of C. dubia. Submit the remaining spiked solutions to SPC for analysis of Total and Dissolved Zinc. This must be done the same day the test begins.
At test completion, retain at least 50ml of each test solution for possible Total and Dissolved Zinc analysis. This determination will be made after review of the toxicity results.

October 15, 2013

Test Results of Acute 48 hour Non-Renewal Biomonitoring Testing for

171137-1: Cu Spiked Effluent
171137-2: Cu Spiked Synthetic Water
171137-3: Zn Spiked Synthetic Water
171137-4: Zn Spiked Effluent

Prepared for:

Mr. Pat Downey
FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Prepared by:

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AMERICAN INTERPLEX CORPORATION LABORATORIES

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Re: Acute 48 hour Non-Renewal Biomonitoring utilizing *Ceriodaphnia dubia*
Zn Spiked Synthetic Water

Dilution Water Samples: Synthetic Moderately Hard Water #4025

Analysis	Result
Dissolved oxygen (mg/l)	8.4
pH (standard units)	8.5
Alkalinity (mg/l as CaCO3)	64
Hardness (mg/l as CaCO3)	81
Conductivity (umhos/cm)	310
Residual Chlorine (mg/l)	<0.05

Results Summary: Zn Spiked Synthetic Water

Ceriodaphnia dubia

The *Ceriodaphnia dubia* test was conducted from October 2, 2013 at 1825 to October 4, 2013 at 1630.

Statistical analyses:
NOEC = 60ppb
LC50 = 139.1ppb

Concentration	24 hour % Survival	48 hour % Survival
Control	95.0	95.0
19.4ppb	100	100
32.4ppb	100	100
54ppb	100	100
60ppb	100	95.0
150ppb	100	55.0 *
250ppb	100	0.00 *

*Significant difference compared to the control (p=0.05)

Ceriodaphnia dubia
Survival Data

Number of organisms per chamber: 5
Volume of test chamber: 30 ml

Age of organisms: <24 hours
Volume of test solution: 15 ml

Effluent Concentration		Number of Survivors 24 Hours	48 Hours	% Survival	CV %
Control	rep. A	5	5	95.0	10.5
	rep. B	5	5		
	rep. C	4	4		
	rep. D	5	5		
19.4ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
32.4ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
54ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
60ppb	rep. A	5	5	95.0	10.5
	rep. B	5	4		
	rep. C	5	5		
	rep. D	5	5		
150ppb	rep. A	5	2	55.0	18.2
	rep. B	5	3		
	rep. C	5	3		
	rep. D	5	3		
250ppb	rep. A	5	0	0.00	0.00
	rep. B	5	0		
	rep. C	5	0		
	rep. D	5	0		

CV = Coefficient of variance = standard deviation X 100/mean

AMERICAN INTERPLEX CORPORATION LABORATORIES

Ceriodaphnia dubia

Transformation of Data — Transform: Arc Sin(Square Root(Y))

Group	Identification	Rep	Value	Transformed
1	Control	1	1.00000	1.34530
1	Control	2	1.00000	1.34530
1	Control	3	0.80000	1.10710
1	Control	4	1.00000	1.34530
2	19.4ppb	1	1.00000	1.34530
2	19.4ppb	2	1.00000	1.34530
2	19.4ppb	3	1.00000	1.34530
2	19.4ppb	4	1.00000	1.34530
3	32.4ppb	1	1.00000	1.34530
3	32.4ppb	2	1.00000	1.34530
3	32.4ppb	3	1.00000	1.34530
3	32.4ppb	4	1.00000	1.34530
4	54ppb	1	1.00000	1.34530
4	54ppb	2	1.00000	1.34530
4	54ppb	3	1.00000	1.34530
4	54ppb	4	1.00000	1.34530
5	60ppb	1	1.00000	1.34530
5	60ppb	2	0.80000	1.10710
5	60ppb	3	1.00000	1.34530
5	60ppb	4	1.00000	1.34530
6	150ppb	1	0.40000	0.68472
6	150ppb	2	0.60000	0.88608
6	150ppb	3	0.60000	0.88608
6	150ppb	4	0.60000	0.88608
7	250ppb	1	0.00000	0.22551
7	250ppb	2	0.00000	0.22551
7	250ppb	3	0.00000	0.22551
7	250ppb	4	0.00000	0.22551

Ceriodaphnia dubia

Shapiro - Wilk's Test for Normality	Transform: Arc Sin(Square Root(Y))
D = 0.1155	
W = 0.6701	
Critical W = 0.896	(alpha = 0.01, N = 28)
Critical W = 0.924	(alpha = 0.05, N = 28)
Data FAIL normality test (alpha = 0.01).	

Steel's Many-One Rank Test — Transform: Arc Sin(Square Root(Y))

Ho:Control<Treatment

Group	Identification	Rank Sum	Critical Value	DF	Sig 0.05
1	Control				
2	19.4ppb	20.00	10.00	4.00	
3	32.4ppb	20.00	10.00	4.00	
4	54ppb	20.00	10.00	4.00	
5	60ppb	18.00	10.00	4.00	
6	150ppb	10.00	10.00	4.00	*
7	250ppb	10.00	10.00	4.00	*

Critical values are 1 tailed (k=6)

Ceriodaphnia dubia

Probit Analysis for Calculating LC/EC Values

Note: Iterations are not converging. This usually means that only one concentration is on the linear portion of the concentration response curve.
It may be possible to fit the data assuming the spontaneous control rate is zero.

Concentration	Number Exposed	Number Responding	Observed Proportion Responding	Proportion Responding Adjusted for Controls	Predicted Proportion Responding
19.4	20	0	0	0	0
32.4	20	0	0	0	0.0001
54	20	0	0	0	0.0066
60	20	1	0.05	0.05	0.0137
150	20	9	0.45	0.45	0.5783
250	20	20	1	1	0.9378

Chi - Square for Heterogeneity (calculated) = 4.748
Chi - Square for Heterogeneity (tabular value at 0.05 level) = 9.488

Mu = 2.143
Sigma = 0.1657

Parameter	Estimate	Std. Error	Lower 95% Conf.	Upper 95% Conf.
Intercept	-7.937	2.51	-12.86	-3.018
Slope	6.036	1.15	3.781	8.291

Theoretical Spontaneous Response Rate = 0

Estimated LC/EC Values and Confidence Limits

LC/EC Point	Exposure Conc.	Lower 95% Conf.	Upper 95% Conf.
1	57.27	31.23	77.04
5	74.28	46.72	94.21
10	85.32	57.72	105.2
15	93.68	66.42	113.7
50	139.1	114.9	164.7
85	206.6	173.5	273.4
90	226.8	188.2	313.2
95	260.5	211.2	385.3
99	337.9	259.3	574.1

Chemical Data for
Ceriodaphnia dubia

Day 1		Control	19.4ppb	32.4ppb	54ppb	60ppb	150ppb	250ppb
DO, mg/l	Initial	8.4	8.2	8.4	8.6	88	8.6	8.5
DO, mg/l	Final	7.5	7.8	7.4	7.8	7.8	7.8	7.6
pH, su	Initial	8.5	8.5	8.3	8.3	8.4	8.3	8.5
pH, su	Final	7.9	7.9	7.7	7.7	7.8	7.8	7.9
Alkalinity, mg/l		64	NA	NA	NA	NA	NA	NA
Hardness, mg/l		81	NA	NA	NA	NA	NA	NA
Conductivity, umho/cm		310	310	310	310	320	310	310
Residual Chlorine, mg/l		<0.05	NA	NA	NA	NA	NA	NA

Day 2		Control	19.4ppb	32.4ppb	54ppb	60ppb	150ppb	250ppb
DO, mg/l	Final	7.7	7.9	7.9	8.0	7.9	7.7	7.9
pH, su	Final	7.9	7.8	7.9	7.9	7.9	7.9	8.0

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Re: Acute 48 hour Non-Renewal Biomonitoring utilizing *Ceriodaphnia dubia*
Zn Spiked Effluent

Dilution Water Samples: North Plant Effluent

Analysis	Result
Dissolved oxygen (mg/l)	7.8
pH (standard units)	7.6
Alkalinity (mg/l as CaCO3)	23
Hardness (mg/l as CaCO3)	70
Conductivity (umhos/cm)	380
Residual Chlorine (mg/l)	NA

Results Summary: Zn Spiked Effluent

Ceriodaphnia dubia

The *Ceriodaphnia dubia* test was conducted from October 2, 2013 at 1730 to October 4, 2013 at 1535.

Statistical analyses:
NOEC = 150ppb
LC50 = 184ppb

Concentration	24 hour % Survival	48 hour % Survival
Control	100	100
19.4ppb	100	100
32.4ppb	100	100
54ppb	100	100
90ppb	100	100
150ppb	95.0	90.0
250ppb	10.0	0.00 *

*Significant difference compared to the control (p=0.05)

AMERICAN INTERPLEX CORPORATION LABORATORIES

Ceriodaphnia dubia
Survival Data

Number of organisms per chamber: 5
Volume of test chamber: 30 ml

Age of organisms: <24 hours
Volume of test solution: 15 ml

Effluent Concentration		Number of Survivors 24 Hours	48 Hours	% Survival	CV %
Control	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
19.4ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
32.4ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
54ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
90ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
150ppb	rep. A	5	4	90.0	12.8
	rep. B	5	5		
	rep. C	5	5		
	rep. D	4	4		
250ppb	rep. A	1	0	0.00	0.00
	rep. B	1	0		
	rep. C	0	0		
	rep. D	0	0		

CV = Coefficient of variance = standard deviation X 100/mean

Ceriodaphnia dubia

Transformation of Data — Transform: Arc Sin(Square Root(Y))

Group	Identification	Rep	Value	Transformed
1	Control	1	1.00000	1.34530
1	Control	2	1.00000	1.34530
1	Control	3	1.00000	1.34530
1	Control	4	1.00000	1.34530
2	19.4ppb	1	1.00000	1.34530
2	19.4ppb	2	1.00000	1.34530
2	19.4ppb	3	1.00000	1.34530
2	19.4ppb	4	1.00000	1.34530
3	32.4ppb	1	1.00000	1.34530
3	32.4ppb	2	1.00000	1.34530
3	32.4ppb	3	1.00000	1.34530
3	32.4ppb	4	1.00000	1.34530
4	54ppb	1	1.00000	1.34530
4	54ppb	2	1.00000	1.34530
4	54ppb	3	1.00000	1.34530
4	54ppb	4	1.00000	1.34530
5	90ppb	1	1.00000	1.34530
5	90ppb	2	1.00000	1.34530
5	90ppb	3	1.00000	1.34530
5	90ppb	4	1.00000	1.34530
6	150ppb	1	0.80000	1.10710
6	150ppb	2	1.00000	1.34530
6	150ppb	3	1.00000	1.34530
6	150ppb	4	0.80000	1.10710
7	250ppb	1	0.00000	0.22551
7	250ppb	2	0.00000	0.22551
7	250ppb	3	0.00000	0.22551
7	250ppb	4	0.00000	0.22551

Ceriodaphnia dubia

Shapiro - Wilk's Test for Normality	Transform: Arc Sin(Square Root(Y))
D = 0.05674	
W = 0.5358	
Critical W = 0.896	(alpha = 0.01, N = 28)
Critical W = 0.924	(alpha = 0.05, N = 28)

Data FAIL normality test (alpha = 0.01).

Steel's Many-One Rank Test — Transform: Arc Sin(Square Root(Y))

Ho:Control<Treatment

Group	Identification	Rank Sum	Critical Value	DF	Sig 0.05
1	Control				
2	19.4ppb	18.00	10.00	4.00	
3	32.4ppb	18.00	10.00	4.00	
4	54ppb	18.00	10.00	4.00	
5	90ppb	18.00	10.00	4.00	
6	150ppb	14.00	10.00	4.00	
7	250ppb	10.00	10.00	4.00	*

Critical values are 1 tailed (k=6)

Ceriodaphnia dubia

Spearman-Karber Method for Calculating LC50 Values					
Concentration	Number Exposed	Number Responding	Proportion Responding	Smoothed Proportion	Smoothed Adjusted Proportion
Control	20	0	0	0	0
19.4	20	0	0	0	0
32.4	20	0	0	0	0
54	20	0	0	0	0
90	20	0	0	0	0
150	20	2	0.1	0.1	0.1
250	20	20	1	1	1

LC50 = 184
Upper Confidence Limit = 197.4
Lower Confidence Limit = 171.5

Variance = 0.0002331

Chemical Data for
Ceriodaphnia dubia

Day 1		Control	19.4ppb	32.4ppb	54ppb	90ppb	150ppb	250ppb
DO, mg/l	Initial	7.8	7.7	7.8	7.8	7.8	7.8	7.8
DO, mg/l	Final	7.3	7.5	7.9	8.0	8.1	8.0	7.7
pH, su	Initial	7.6	7.8	7.8	7.8	7.9	7.9	7.8
pH, su	Final	7.5	7.5	7.6	7.6	7.6	7.6	7.5
Alkalinity, mg/l		23	NA	NA	NA	NA	NA	NA
Hardness, mg/l		70	NA	NA	NA	NA	NA	NA
Conductivity, umho/cm		380	380	380	350	320	380	370

Day 2		Control	19.4ppb	32.4ppb	54ppb	90ppb	150ppb	250ppb
DO, mg/l	Final	7.8	7.8	8.1	7.8	7.8	7.9	7.8
pH, su	Final	7.7	7.8	7.8	7.8	7.8	7.8	7.9

AMERICAN INTERPLEX CORPORATION LABORATORIES

COPY

171137

CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

PAGE OF

Client: VAN BUREN MONICIPAL UTILITIES
Project Reference: NORTH PLANT
Project Manager: CLYDE Hill
Sampled By: [signature]
PO No.:

AIC CONTROL NO: ~~171106~~ GEH17
AIC PROPOSAL NO:
Carrier/Tracking No. Fed-X
Received Temperature C 3.1

AIC No.	Sample Identification	Date/Time Collected	GRAB	COMP	WATER	SOIL		NO OF BOTTLES	WER STUDY												Remarks
1	NPE1	9/29-30/13 8:00-8:15 Am		X	X			3	X												6.93/5°
																					Field pH calibration
		Container Type						P													on 9/30 @ 7:45
		Preservative						NO													Buffer: 4.7

G = Glass · P = Plastic · V = VOA vials · H = HCl to pH2 · T = Sodium Thiosulfate
NO = none · S = Sulfuric acid pH2 · N = Nitric acid pH2 · B = NaOH to pH12 · Z = Zinc acetate

Turnaround Time Requested: (Please circle)
NORMAL or EXPEDITED IN ____ DAYS
Expedited results requested by:
Who should AIC contact with questions: Clyde Hill / FTN
Phone: 479-719-6508 Fax:
Report Attention to: VBFred@aol.com
Report Address to:

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	9/30/13 10:47	FEDEX-C 029865615001485	9/30/13 10:47
Relinquished By:	Date/Time	Received in Lab By:	Date/Time
		[signature]	10-1-13 1225

Comments: 9612019 0298 656 1500148S

19-Oct-09

FORM 0060

Title: VanBuren 1st def zn effluent total
File: VB1ZNEFT.IN Transform: LOG 10 DOSE

Spearman - Karber Estimate

Estimated EC50: 200.0437 95% Confidence Interval: (192.1650, 208.2454)
[p1 = p2 true; Unconditional Variance] : (192.0073, 208.4164)
[p1 = p2 true; Conditional Variance] : (192.1650, 208.2454)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	CONTROL	1.0000	1.0000	1.4772
2	77.5	1.0000	1.0000	1.8893
3	86.0	1.0000	1.0000	1.9345
4	98.5	1.0000	1.0000	1.9934
5	135.4	1.0000	1.0000	2.1316
6	170.5	0.9000	0.9000	2.2317
7	249.5	0.0000	0.0000	2.3971

Title: VanBuren 1st def zn effluent total
File: VB1ZNEFT.IN Transform: LOG 10 DOSE

Trimmed Spearman - Karber		Estimate	95% C.I.	UNCONDITIONAL 95% C.I.
	10.00%	201.9350	(195.79,208.27)	(195.67,208.40)
	20.00%	201.9350	(195.79,208.27)	(195.67,208.40)
HIGH CALC	10.00%	201.9350	(195.79,208.27)	(195.67,208.40)
LOW CALC	0.00%	200.0437	(192.16,208.25)	(192.01,208.42)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	CONTROL	1.0000	1.0000	1.4772
2	77.5	1.0000	1.0000	1.8893
3	86.0	1.0000	1.0000	1.9345
4	98.5	1.0000	1.0000	1.9934
5	135.4	1.0000	1.0000	2.1316
6	170.5	0.9000	0.9000	2.2317
7	249.5	0.0000	0.0000	2.3971

Title: VanBuren 1st def zn WER dissolved
File: VB1ZNEFD.IN Transform: LOG 10 DOSE

Spearman - Karber Estimate

Estimated EC50: 182.2135 95% Confidence Interval: (175.1935, 189.5148)
[p1 = p2 true; Unconditional Variance] : (175.0529, 189.6669)
[p1 = p2 true; Conditional Variance] : (175.1935, 189.5148)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	CONTROL	1.0000	1.0000	1.4597
2	72.6	1.0000	1.0000	1.8609
3	84.9	1.0000	1.0000	1.9289
4	97.8	1.0000	1.0000	1.9903
5	123.5	1.0000	1.0000	2.0917
6	157.0	0.9000	0.9000	2.1959
7	224.5	0.0000	0.0000	2.3512

Title: VanBuren 1st def zn WER dissolved
File: VB1ZNEFD.IN Transform: LOG 10 DOSE

Trimmed Spearman - Karber	Estimate	95% C.I.	UNCONDITIONAL 95% C.I.
10.00%	184.0472	(178.78,189.47)	(178.68,189.58)
20.00%	184.0472	(178.78,189.47)	(178.68,189.58)
HIGH CALC 10.00%	184.0472	(178.78,189.47)	(178.68,189.58)
LOW CALC 0.00%	182.2135	(175.19,189.51)	(175.05,189.67)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	CONTROL	1.0000	1.0000	1.4597
2	72.6	1.0000	1.0000	1.8609
3	84.9	1.0000	1.0000	1.9289
4	97.8	1.0000	1.0000	1.9903
5	123.5	1.0000	1.0000	2.0917
6	157.0	0.9000	0.9000	2.1959
7	224.5	0.0000	0.0000	2.3512

Title: VanBuren 1st def zn WER lab total
File: VB1ZNLAT.IN Transform: LOG 10 DOSE

Probit Analysis - not Using Smoothed Proportions

DOSE	NUMBER SUBJECTS	NUMBER OBSERVED	OBSERVED PROPORTION	PREDICTED PROPORTION
13.50	20	20	1.0000	1.0000
34.20	20	20	1.0000	1.0000
51.20	20	20	1.0000	1.0000
90.00	20	19	0.9500	0.9652
135.00	20	11	0.5500	0.5117
231.00	20	0	0.0000	0.0097

Est. Mu = 2.1332 Est. Sigma = 0.0986
sd = 0.0241 sd = 0.0231

Chi-Square lack of fit = 0.4529 Likelihood lack of fit = 0.6318
Table Chi-square = 13.2767 (alpha = 0.01, df = 4)
Table Chi-square = 9.4877 (alpha = 0.05, df = 4)

Title: VanBuren 1st def zn WER lab total
File: VB1ZNLAT.IN Transform: LOG 10 DOSE

Probit EC Estimates
WITHOUT CONTROL DATA

POINT	EST. END POINT	95% CONFIDENCE LIMITS	
EC 1	80.1366	62.9017	102.0937
EC 5	93.5469	78.0743	112.0860
EC10	101.5905	87.2954	118.2265
EC20	112.2619	99.2727	126.9507
EC25	116.6038	103.9323	130.8202
EC30	120.6458	108.0977	134.6505
EC40	128.3038	115.4258	142.6186
EC50	135.9004	121.8991	151.5099
EC60	143.9468	127.9613	161.9294
EC70	153.0839	134.0715	174.7923
EC75	158.3905	137.3376	182.6706
EC80	164.5164	140.9115	192.0754
EC90	181.7978	150.1815	220.0699
EC95	197.4295	157.8637	246.9118
EC99	230.4682	172.7343	307.4987

Title: VanBuren 1st def zn WER lab total
File: VB1ZNLAT.IN Transform: LOG 10 DOSE

Spearman - Karber Estimate

Estimated EC50: 140.7003 95% Confidence Interval: (116.6619, 169.6917)
[p1 = p2 true; Unconditional Variance] : (125.7165, 157.4698)
[p1 = p2 true; Conditional Variance] : (113.3922, 174.5849)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	<6	0.9500	0.9875	0.8671
2	13.5	1.0000	0.9875	1.1303
3	34.2	1.0000	0.9875	1.5340
4	51.2	1.0000	0.9875	1.7093
5	90.0	0.9500	0.9500	1.9542
6	135.0	0.5500	0.5500	2.1303
7	231.0	0.0000	0.0000	2.3636

Title: VanBuren 1st def zn WER lab total
File: VB1ZNLAT.IN Transform: LOG 10 DOSE

Trimmed Spearman - Karber		Estimate	95% C.I.	UNCONDITIONAL 95% C.I.
	10.00%	142.2406	(124.47,162.55)	(125.14,161.68)
	20.00%	142.3672	(122.08,166.03)	(122.53,165.41)
HIGH CALC	3.80%	142.1613	(125.94,160.48)	(126.77,159.42)
LOW CALC	0.00%	140.7003	(122.87,161.11)	(125.72,157.47)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	<6	0.9500	0.9875	0.8671
2	13.5	1.0000	0.9875	1.1303
3	34.2	1.0000	0.9875	1.5340
4	51.2	1.0000	0.9875	1.7093
5	90.0	0.9500	0.9500	1.9542
6	135.0	0.5500	0.5500	2.1303
7	231.0	0.0000	0.0000	2.3636

Title: VanBuren 1st def zn WER lab dissolved
File: VB1ZNLAD.IN Transform: LOG 10 DOSE

Probit Analysis - not Using Smoothed Proportions

DOSE	NUMBER SUBJECTS	NUMBER OBSERVED	OBSERVED PROPORTION	PREDICTED PROPORTION
19.50	20	20	1.0000	1.0000
33.50	20	20	1.0000	1.0000
46.90	20	20	1.0000	1.0000
85.50	20	19	0.9500	0.9691
131.50	20	11	0.5500	0.4982
216.50	20	0	0.0000	0.0149

Est. Mu = 2.1185 Est. Sigma = 0.0999
sd = 0.0238 sd = 0.0224

Chi-Square lack of fit = 0.7599 Likelihood lack of fit = 1.0215
Table Chi-square = 13.2767 (alpha = 0.01, df = 4)
Table Chi-square = 9.4877 (alpha = 0.05, df = 4)

Title: VanBuren 1st def zn WER lab dissolved
File: VB1ZNLAD.IN Transform: LOG 10 DOSE

Probit EC Estimates
WITHOUT CONTROL DATA

POINT	EST. END POINT	95% CONFIDENCE LIMITS	
EC 1	76.9300	60.2989	98.1480
EC 5	89.9853	74.8578	108.1698
EC10	97.8279	83.7371	114.2898
EC20	108.2451	95.3564	122.8760
EC25	112.4873	99.9236	126.6308
EC30	116.4384	104.0396	130.3149
EC40	123.9289	111.3756	137.8971
EC50	131.3651	117.9642	146.2883
EC60	139.2475	124.2088	156.1071
EC70	148.2053	130.5422	168.2583
EC75	153.4110	133.9336	175.7208
EC80	159.4232	137.6459	184.6460
EC90	176.3995	147.2739	211.2851
EC95	191.7734	155.2542	236.8827
EC99	224.3182	170.7247	294.7357

Title: VanBuren 1st def zn WER lab dissolved
File: VB1ZNLAD.IN Transform: LOG 10
DOSE

Spearman - Karber Estimate

Estimated EC50: 134.6819 95% Confidence Interval: (113.4314,
159.9134)
[p1 = p2 true; Unconditional Variance] : (120.3861,
150.6752)
[p1 = p2 true; Conditional Variance] : (109.0331,
166.3642)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	<6	0.9500	0.9875	0.9627
2	19.5	1.0000	0.9875	1.2900
3	33.5	1.0000	0.9875	1.5250
4	46.9	1.0000	0.9875	1.6712
5	85.5	0.9500	0.9500	1.9320
6	131.5	0.5500	0.5500	2.1189
7	216.5	0.0000	0.0000	2.3355

Title: VanBuren 1st def zn WER lab dissolved
File: VB1ZNLAD.IN Transform: LOG 10
DOSE

Trimmed Spearman - Karber		Estimate	95% C.I.	UNCONDITIONAL 95% C.I.
	10.00%	136.6841	(119.79,155.96)	(120.45,155.11)
	20.00%	137.2425	(117.95,159.70)	(118.39,159.10)
HIGH CALC	3.80%	136.3356	(120.93,153.71)	(121.75,152.67)
LOW CALC	0.00%	134.6819	(117.51,154.36)	(120.39,150.68)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	<6	0.9500	0.9875	0.9627
2	19.5	1.0000	0.9875	1.2900
3	33.5	1.0000	0.9875	1.5250
4	46.9	1.0000	0.9875	1.6712
5	85.5	0.9500	0.9500	1.9320
6	131.5	0.5500	0.5500	2.1189
7	216.5	0.0000	0.0000	2.3355

AMERICAN INTERPLEX CORPORATION LABORATORIES

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

This report contains the analytical results and supporting information for samples submitted on January 31, 2014. Attached please find a copy of the Chain of Custody and/or other documents received. Note that any remaining sample will be discarded two weeks from the original report date unless other arrangements are made.

This report is intended for the sole use of the client listed above. Assessment of the data requires access to the entire document.

This report has been reviewed by the Laboratory Director or a qualified designee.

John Overbey
Laboratory Director

This document has been distributed to the following:

PDF cc: FTN Associates, Ltd.
ATTN: Mr. Pat Downey
pjd@ftn-assoc.com

AMERICAN INTERPLEX CORPORATION LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

SAMPLE INFORMATION

Project Description:
One (1) water sample(s) received on January 31, 2014

Receipt Details:
A Chain of Custody was provided. The samples were delivered in one (1) ice chest.
Ice chest #1 was delivered with shipping documentation.

Each sample container was checked for proper labeling, including date and time sampled. Sample containers were reviewed for proper type, adequate volume, integrity, temperature, preservation, and holding times. Any exceptions are noted below:

Sample Identification:

Laboratory ID	Client Sample ID	Sampled Date/Time	Notes
174996-1	NPE 1 1/29-30/14 10:00-10:00a	30-Jan-2014 1000	
174996-2	Effluent-CD-250ppb-Initial		
174996-3	Effluent-CD-162ppb-Initial		
174996-4	Effluent-CD-106ppb-Initial		
174996-5	Effluent-CD-68.7ppb-Initial		
174996-6	Effluent-CD-44.6ppb-Initial		
174996-7	Effluent-CD-29.0ppb-Initial		
174996-8	Synthetic MOD-CD-250ppb-Initial		
174996-9	Synthetic MOD-CD-162ppb-Initial		
174996-10	Synthetic MOD-CD-106ppb-Initial		
174996-11	Synthetic MOD-CD-68.7ppb-Initial		
174996-12	Synthetic MOD-CD-44.6ppb-Initial		
174996-13	Synthetic MOD-CD-29.0ppb-Initial		
174996-14	Effluent-P.promelas-1500ppb-Initial		
174996-15	Effluent-P.promelas-975ppb-Initial		
174996-16	Effluent-P.promelas-634ppb-Initial		
174996-17	Effluent-P.promelas-412ppb-Initial		
174996-18	Effluent-P.promelas-268ppb-Initial		
174996-19	Effluent-P.promelas-174ppb-Initial		
174996-20	Synthetic MOD-P.promelas-1500ppb-Initial		
174996-21	Synthetic MOD-P.promelas-975ppb-Initial		
174996-22	Synthetic MOD-P.promelas-634ppb-Initial		
174996-23	Synthetic MOD-P.promelas-412ppb-Initial		
174996-24	Synthetic MOD-P.promelas-268ppb-Initial		
174996-25	Synthetic MOD-P.promelas-174ppb-Initial		
174996-26	Effluent-CD-250ppb-Final		
174996-27	Effluent-CD-162ppb-Final		
174996-28	Effluent-CD-106ppb-Final		
174996-29	Effluent-CD-68.7ppb-Final		
174996-30	Effluent-CD-44.6ppb-Final		
174996-31	Effluent-CD-29.0ppb-Final		
174996-32	Synthetic MOD-CD-250ppb-Final		
174996-33	Synthetic MOD-CD-162ppb-Final		
174996-34	Synthetic MOD-CD-106ppb-Final		
174996-35	Synthetic MOD-CD-68.7ppb-Final		
174996-36	Synthetic MOD-CD-44.6ppb-Final		
174996-37	Synthetic MOD-CD-29.0ppb-Final		

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SAMPLE INFORMATION

Laboratory ID	Client Sample ID	Sampled Date/Time	Notes
174996-38	Effluent-P.promelas-1500ppb-Final		
174996-39	Effluent-P.promelas-975ppb-Final		
174996-40	Effluent-P.promelas-634ppb-Final		
174996-41	Effluent-P.promelas-412ppb-Final		
174996-42	Effluent-P.promelas-268ppb-Final		
174996-43	Effluent-P.promelas-174ppb-Final		
174996-44	Synthetic MOD-P.promelas-1500ppb-Final		
174996-45	Synthetic MOD-P.promelas-975ppb-Final		
174996-46	Synthetic MOD-P.promelas-634ppb-Final		
174996-47	Synthetic MOD-P.promelas-412ppb-Final		
174996-48	Synthetic MOD-P.promelas-268ppb-Final		
174996-49	Synthetic MOD-P.promelas-174ppb-Final		
174996-50	Effluent-CD-250ppb-Final		

Qualifiers:

H Analytical holding time exceeded regulatory requirements

Case Narrative:

Table II of 40 CFR Part 136.3 indicates analysis of pH, Total Residual Chlorine, and Dissolved Oxygen are to be performed on site or immediately after collection. American Interplex Corporation analyzes these parameters as soon as possible after laboratory receipt.

References:

"Methods for Chemical Analysis of Water and Wastes", EPA/600/4-79-020 (Mar 1983) with updates and supplements EPA/600/5-91-010 (Jun 1991), EPA/600/R-92-129 (Aug 1992) and EPA/600/R-93-100 (Aug 1993).
"Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846)", Third Edition.
"Standard Methods for the Examination of Water and Wastewaters", 21st edition.
"American Society for Testing and Materials" (ASTM).
"Association of Analytical Chemists" (AOAC).

AMERICAN INTERPLEX CORPORATION LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 174996-1
Sample Identification: NPE 1 1/29-30/14 10:00-10:00a

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3 SM 2320 B 1997		**13** Analyzed: 03-Feb-2014 0925 by 93	1	**mg/l** Batch: W46508	
Ammonia as N SM 4500 NH3N B		**< 0.1** Analyzed: 07-Feb-2014 1250 by 93	0.1	**mg/l** Batch: W46559	
pH SM 4500-H+ B 2000		**6.7** Analyzed: 31-Jan-2014 1502 by 93		**Units** Batch: W46497	H
Carbonaceous BOD 5-day SM 5210 B 2001	Prep: 31-Jan-2014 1504 by 285	**< 2** Analyzed: 05-Feb-2014 0950 by 285	2	**mg/l** Batch: W46491	
Total Organic Carbon SM 5310 C 2000	Prep: 11-Feb-2014 1141 by 308	**3.8** Analyzed: 12-Feb-2014 0854 by 308	1	**mg/l** Batch: W46592	
Total Suspended Solids USGS 3765	Prep: 04-Feb-2014 0932 by 302	**< 4** Analyzed: 04-Feb-2014 1627 by 302	4	**mg/l** Batch: W46519	
Hardness as CaCO3 SM 2340 B 1997	Prep: 05-Feb-2014 0929 by 305	**42.7** Analyzed: 05-Feb-2014 1308 by 305	1	**mg/l** Batch: S36208	
Dissolved Organic Carbon SM 5310 C 2000	Prep: 11-Feb-2014 1142 by 308	**3.5** Analyzed: 12-Feb-2014 1145 by 308	1	**mg/l** Batch: W46592	
Dissolved Zinc EPA 200.7	Prep: 31-Jan-2014 0800 by 235	**94.6** Analyzed: 31-Jan-2014 1639 by 305	2	**ug/l** Batch: S36199	
Dissolved Copper EPA 200.8	Prep: 05-Feb-2014 0929 by 305	**4.73** Analyzed: 05-Feb-2014 1302 by 305	1	**ug/l** Batch: S36208	
Total Recoverable Zinc EPA 200.7	Prep: 31-Jan-2014 0800 by 235	**95.1** Analyzed: 31-Jan-2014 1642 by 305	2	**ug/l** Batch: S36199	
Total Recoverable Copper EPA 200.8	Prep: 05-Feb-2014 0929 by 305	**5.61** Analyzed: 05-Feb-2014 1308 by 305	1	**ug/l** Batch: S36208	

AIC No. 174996-2
Sample Identification: Effluent-CD-250ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc EPA 200.7	Prep: 31-Jan-2014 0800 by 235	**327** Analyzed: 31-Jan-2014 1745 by 305	2	**ug/l** Batch: S36199	
Total Recoverable Zinc EPA 200.7	Prep: 31-Jan-2014 0800 by 235	**337** Analyzed: 31-Jan-2014 1747 by 305	2	**ug/l** Batch: S36199	

AIC No. 174996-3
Sample Identification: Effluent-CD-162ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc EPA 200.7	Prep: 31-Jan-2014 0800 by 235	**244** Analyzed: 31-Jan-2014 1739 by 305	2	**ug/l** Batch: S36199	
Total Recoverable Zinc EPA 200.7	Prep: 31-Jan-2014 0800 by 235	**246** Analyzed: 31-Jan-2014 1742 by 305	2	**ug/l** Batch: S36199	

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ANALYTICAL RESULTS

AIC No. 174996-4
Sample Identification: Effluent-CD-106ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**194**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 0800 by 235	Analyzed: 31-Jan-2014 1734 by 305		Batch: S36199	
Total Recoverable Zinc		**196**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 0800 by 235	Analyzed: 31-Jan-2014 1737 by 305		Batch: S36199	

AIC No. 174996-5
Sample Identification: Effluent-CD-68.7ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**158**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 0800 by 235	Analyzed: 31-Jan-2014 1723 by 305		Batch: S36199	
Total Recoverable Zinc		**159**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 0800 by 235	Analyzed: 31-Jan-2014 1726 by 305		Batch: S36199	

AIC No. 174996-6
Sample Identification: Effluent-CD-44.6ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**135**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 0800 by 235	Analyzed: 31-Jan-2014 1718 by 305		Batch: S36199	
Total Recoverable Zinc		**136**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 0800 by 235	Analyzed: 31-Jan-2014 1720 by 305		Batch: S36199	

AIC No. 174996-7
Sample Identification: Effluent-CD-29.0ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**124**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 0800 by 235	Analyzed: 31-Jan-2014 1634 by 305		Batch: S36199	
Total Recoverable Zinc		**125**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 0800 by 235	Analyzed: 31-Jan-2014 1637 by 305		Batch: S36199	

AIC No. 174996-8
Sample Identification: Synthetic MOD-CD-250ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**236**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1427 by 305		Batch: S36198	
Total Recoverable Zinc		**241**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1430 by 305		Batch: S36198	

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ANALYTICAL RESULTS

AIC No. 174996-9
Sample Identification: Synthetic MOD-CD-162ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**160**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1416 by 305		Batch: S36198	
Total Recoverable Zinc		**161**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1419 by 305		Batch: S36198	

AIC No. 174996-10
Sample Identification: Synthetic MOD-CD-106ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**102**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1411 by 305		Batch: S36198	
Total Recoverable Zinc		**104**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1413 by 305		Batch: S36198	

AIC No. 174996-11
Sample Identification: Synthetic MOD-CD-68.7ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**67.9**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1405 by 305		Batch: S36198	
Total Recoverable Zinc		**67.0**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1408 by 305		Batch: S36198	

AIC No. 174996-12
Sample Identification: Synthetic MOD-CD-44.6ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**43.7**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1400 by 305		Batch: S36198	
Total Recoverable Zinc		**43.7**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1402 by 305		Batch: S36198	

AIC No. 174996-13
Sample Identification: Synthetic MOD-CD-29.0ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**29.4**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1354 by 305		Batch: S36198	
Total Recoverable Zinc		**28.3**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1357 by 305		Batch: S36198	

AMERICAN INTERPLEX CORPORATION LABORATORIES

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Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 174996-14
Sample Identification: Effluent-P.promelas-1500ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**1650**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 0800 by 235	Analyzed: 31-Jan-2014 1629 by 305		Batch: S36199	
Total Recoverable Zinc		**1690**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 0800 by 235	Analyzed: 31-Jan-2014 1631 by 305		Batch: S36199	

AIC No. 174996-15
Sample Identification: Effluent-P.promelas-975ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**1110**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 0800 by 235	Analyzed: 31-Jan-2014 1645 by 305		Batch: S36199	
Total Recoverable Zinc		**1110**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 0800 by 235	Analyzed: 31-Jan-2014 1648 by 305		Batch: S36199	

AIC No. 174996-16
Sample Identification: Effluent-P.promelas-634ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**741**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 0800 by 235	Analyzed: 31-Jan-2014 1650 by 305		Batch: S36199	
Total Recoverable Zinc		**755**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 0800 by 235	Analyzed: 31-Jan-2014 1653 by 305		Batch: S36199	

AIC No. 174996-17
Sample Identification: Effluent-P.promelas-412ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**516**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 0800 by 235	Analyzed: 31-Jan-2014 1701 by 305		Batch: S36199	
Total Recoverable Zinc		**520**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 0800 by 235	Analyzed: 31-Jan-2014 1704 by 305		Batch: S36199	

AIC No. 174996-18
Sample Identification: Effluent-P.promelas-268ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**366**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 0800 by 235	Analyzed: 31-Jan-2014 1707 by 305		Batch: S36199	
Total Recoverable Zinc		**371**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 0800 by 235	Analyzed: 31-Jan-2014 1709 by 305		Batch: S36199	

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ANALYTICAL RESULTS

AIC No. 174996-19
Sample Identification: Effluent-P.promelas-174ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**270**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 0800 by 235	Analyzed: 31-Jan-2014 1712 by 305		Batch: S36199	
Total Recoverable Zinc		**272**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 0800 by 235	Analyzed: 31-Jan-2014 1715 by 305		Batch: S36199	

AIC No. 174996-20
Sample Identification: Synthetic MOD-P.promelas-1500ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**1380**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1505 by 305		Batch: S36198	
Total Recoverable Zinc		**1490**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1508 by 305		Batch: S36198	

AIC No. 174996-21
Sample Identification: Synthetic MOD-P.promelas-975ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**984**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1459 by 305		Batch: S36198	
Total Recoverable Zinc		**989**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1502 by 305		Batch: S36198	

AIC No. 174996-22
Sample Identification: Synthetic MOD-P.promelas-634ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**629**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1449 by 305		Batch: S36198	
Total Recoverable Zinc		**648**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1451 by 305		Batch: S36198	

AIC No. 174996-23
Sample Identification: Synthetic MOD-P.promelas-412ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**410**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1443 by 305		Batch: S36198	
Total Recoverable Zinc		**416**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1446 by 305		Batch: S36198	

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ANALYTICAL RESULTS

AIC No. 174996-24
Sample Identification: Synthetic MOD-P.promelas-268ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**263**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1438 by 305		Batch: S36198	
Total Recoverable Zinc		**266**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1440 by 305		Batch: S36198	

AIC No. 174996-25
Sample Identification: Synthetic MOD-P.promelas-174ppb-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**172**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1432 by 305		Batch: S36198	
Total Recoverable Zinc		**173**	2	**ug/l**	
EPA 200.7	Prep: 31-Jan-2014 1300 by 305	Analyzed: 31-Jan-2014 1435 by 305		Batch: S36198	

AIC No. 174996-26
Sample Identification: Effluent-CD-250ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**344**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1517 by 305		Batch: S36201	
Total Recoverable Zinc		**351**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1520 by 305		Batch: S36201	

AIC No. 174996-27
Sample Identification: Effluent-CD-162ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**255**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1512 by 305		Batch: S36201	
Total Recoverable Zinc		**263**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1515 by 305		Batch: S36201	

AIC No. 174996-28
Sample Identification: Effluent-CD-106ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**195**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1507 by 305		Batch: S36201	
Total Recoverable Zinc		**198**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1509 by 305		Batch: S36201	

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ANALYTICAL RESULTS

AIC No. 174996-29
Sample Identification: Effluent-CD-68.7ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**162**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1456 by 305		Batch: S36201	
Total Recoverable Zinc		**166**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1459 by 305		Batch: S36201	

AIC No. 174996-30
Sample Identification: Effluent-CD-44.6ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**145**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1451 by 305		Batch: S36201	
Total Recoverable Zinc		**144**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1454 by 305		Batch: S36201	

AIC No. 174996-31
Sample Identification: Effluent-CD-29.0ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**136**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1446 by 305		Batch: S36201	
Total Recoverable Zinc		**135**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1448 by 305		Batch: S36201	

AIC No. 174996-32
Sample Identification: Synthetic MOD-CD-250ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**258**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1404 by 305		Batch: S36201	
Total Recoverable Zinc		**259**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1406 by 305		Batch: S36201	

AIC No. 174996-33
Sample Identification: Synthetic MOD-CD-162ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**169**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1353 by 305		Batch: S36201	
Total Recoverable Zinc		**170**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1356 by 305		Batch: S36201	

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ANALYTICAL RESULTS

AIC No. 174996-34
Sample Identification: Synthetic MOD-CD-106ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**109**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1348 by 305		Batch: S36201	
Total Recoverable Zinc		**109**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1351 by 305		Batch: S36201	

AIC No. 174996-35
Sample Identification: Synthetic MOD-CD-68.7ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**71.6**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1343 by 305		Batch: S36201	
Total Recoverable Zinc		**70.9**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1345 by 305		Batch: S36201	

AIC No. 174996-36
Sample Identification: Synthetic MOD-CD-44.6ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**47.2**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1338 by 305		Batch: S36201	
Total Recoverable Zinc		**47.9**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1340 by 305		Batch: S36201	

AIC No. 174996-37
Sample Identification: Synthetic MOD-CD-29.0ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**36.3**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1332 by 305		Batch: S36201	
Total Recoverable Zinc		**36.1**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1335 by 305		Batch: S36201	

AIC No. 174996-38
Sample Identification: Effluent-P.promelas-1500ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**1770**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1554 by 305		Batch: S36201	
Total Recoverable Zinc		**1780**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1557 by 305		Batch: S36201	

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ANALYTICAL RESULTS

AIC No. 174996-39
Sample Identification: Effluent-P.promelas-975ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**1140**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1549 by 305		Batch: S36201	
Total Recoverable Zinc		**1220**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1552 by 305		Batch: S36201	

AIC No. 174996-40
Sample Identification: Effluent-P.promelas-634ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**797**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1544 by 305		Batch: S36201	
Total Recoverable Zinc		**830**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1546 by 305		Batch: S36201	

AIC No. 174996-41
Sample Identification: Effluent-P.promelas-412ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**550**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1538 by 305		Batch: S36201	
Total Recoverable Zinc		**568**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1541 by 305		Batch: S36201	

AIC No. 174996-42
Sample Identification: Effluent-P.promelas-268ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**403**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1528 by 305		Batch: S36201	
Total Recoverable Zinc		**401**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1531 by 305		Batch: S36201	

AIC No. 174996-43
Sample Identification: Effluent-P.promelas-174ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**290**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1523 by 305		Batch: S36201	
Total Recoverable Zinc		**302**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1525 by 305		Batch: S36201	

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ANALYTICAL RESULTS

AIC No. 174996-44
Sample Identification: Synthetic MOD-P.promelas-1500ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**1130**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1441 by 305		Batch: S36201	
Total Recoverable Zinc		**1460**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1443 by 305		Batch: S36201	

AIC No. 174996-45
Sample Identification: Synthetic MOD-P.promelas-975ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**829**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1435 by 305		Batch: S36201	
Total Recoverable Zinc		**968**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1438 by 305		Batch: S36201	

AIC No. 174996-46
Sample Identification: Synthetic MOD-P.promelas-634ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**673**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1425 by 305		Batch: S36201	
Total Recoverable Zinc		**683**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1428 by 305		Batch: S36201	

AIC No. 174996-47
Sample Identification: Synthetic MOD-P.promelas-412ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**431**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1420 by 305		Batch: S36201	
Total Recoverable Zinc		**434**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1422 by 305		Batch: S36201	

AIC No. 174996-48
Sample Identification: Synthetic MOD-P.promelas-268ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**283**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1414 by 305		Batch: S36201	
Total Recoverable Zinc		**286**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1417 by 305		Batch: S36201	

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ANALYTICAL RESULTS

AIC No. 174996-49
Sample Identification: Synthetic MOD-P.promelas-174ppb-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Zinc		**183**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1409 by 305		Batch: S36201	
Total Recoverable Zinc		**183**	2	**ug/l**	
EPA 200.7	Prep: 04-Feb-2014 1157 by 305	Analyzed: 04-Feb-2014 1412 by 305		Batch: S36201	

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DUPLICATE RESULTS

Analyte		AIC No.	Result	RPD	RPD Limit	Preparation Date	Analysis Date	Dil	Qual
Carbonaceous BOD 5-day		174935-1	< 2 mg/l			31Jan14 0819 by 285	05Feb14 0849 by 285		
	Batch: W46491	Duplicate	< 2 mg/l	0.00	20.0	31Jan14 0819 by 285	05Feb14 0851 by 285		
pH		174996-1	6.7 Units				31Jan14 1502 by 93		H
	Batch: W46497	Duplicate	6.7 Units	0.149	5.00		31Jan14 1502 by 93		H
Alkalinity as CaCO3		174946-1	260 mg/l				03Feb14 0925 by 93		
	Batch: W46508	Duplicate	260 mg/l	0.00	20.0		03Feb14 0925 by 93		
Total Suspended Solids		174944-3	130 mg/l			04Feb14 0932 by 302	04Feb14 1627 by 302		
	Batch: W46519	Duplicate	120 mg/l	8.26	20.0	04Feb14 0932 by 302	04Feb14 1627 by 302		
Total Suspended Solids		174946-3	3600 mg/l			04Feb14 0932 by 302	04Feb14 1627 by 302		
	Batch: W46519	Duplicate	3600 mg/l	1.12	20.0	04Feb14 0932 by 302	04Feb14 1627 by 302		

LABORATORY CONTROL SAMPLE RESULTS

Analyte	Spike Amount	%	Limits	RPD	Limit	Batch	Preparation Date	Analysis Date	Dil	Qual
Ammonia as N	1 mg/l	106	80.0-120			W46559		07Feb14 1252 by 93		
pH	-	100	98.0-102			W46497		31Jan14 1502 by 93		
Carbonaceous BOD 5-day	200 mg/l	97.3	84.5-115			W46491	31Jan14 0819 by 285	05Feb14 0848 by 285		
Total Organic Carbon	10 mg/l	103	80.0-120			W46592	11Feb14 1141 by 308	12Feb14 0735 by 308		
Zinc	0.5 mg/l	97.8	85.0-115			S36198	31Jan14 1300 by 305	31Jan14 1344 by 305		
	0.5 mg/l	98.0	85.0-115	0.204	20.0	S36198	31Jan14 1300 by 305	31Jan14 1424 by 305		
Zinc	0.5 mg/l	99.0	85.0-115			S36199	31Jan14 0800 by 235	31Jan14 1513 by 305		
	0.5 mg/l	96.6	85.0-115	2.45	20.0	S36199	31Jan14 0800 by 235	31Jan14 1753 by 305		
Zinc	0.5 mg/l	101	85.0-115			S36201	04Feb14 1157 by 305	04Feb14 1322 by 305		
	0.5 mg/l	101	85.0-115	0.138	20.0	S36201	04Feb14 1157 by 305	04Feb14 1401 by 305		
Copper	0.05 mg/l	98.1	85.0-115			S36208	05Feb14 0929 by 305	05Feb14 1228 by 305		
	0.05 mg/l	98.0	85.0-115	0.181	20.0	S36208	05Feb14 0929 by 305	05Feb14 1406 by 305		
Dissolved Organic Carbon	10 mg/l	103	85.0-115			W46592	11Feb14 1141 by 308	12Feb14 0735 by 308		
Total Recoverable Zinc	0.5 mg/l	97.8	85.0-115			S36198	31Jan14 1300 by 305	31Jan14 1344 by 305		
	0.5 mg/l	98.0	85.0-115	0.204	20.0	S36198	31Jan14 1300 by 305	31Jan14 1424 by 305		
Total Recoverable Zinc	0.5 mg/l	99.0	85.0-115			S36199	31Jan14 0800 by 235	31Jan14 1513 by 305		
	0.5 mg/l	96.6	85.0-115	2.45	20.0	S36199	31Jan14 0800 by 235	31Jan14 1753 by 305		
Total Recoverable Zinc	0.5 mg/l	101	85.0-115			S36201	04Feb14 1157 by 305	04Feb14 1322 by 305		
	0.5 mg/l	101	85.0-115	0.138	20.0	S36201	04Feb14 1157 by 305	04Feb14 1401 by 305		
Total Recoverable Copper	0.05 mg/l	98.1	85.0-115			S36208	05Feb14 0929 by 305	05Feb14 1228 by 305		
	0.05 mg/l	98.0	85.0-115	0.181	20.0	S36208	05Feb14 0929 by 305	05Feb14 1406 by 305		

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MATRIX SPIKE SAMPLE RESULTS

Analyte	Sample	Spike Amount	%	Limits	Batch	Preparation Date	Analysis Date	Dil	Qual
Ammonia as N	175192-1	1 mg/l	118	80.0-120	W46559		07Feb14 1623 by 93		
	175192-1	1 mg/l	117	80.0-120	W46559		07Feb14 1623 by 93		
	Relative Percent Difference:		0.554	25.0	W46559				
Total Organic Carbon	175147-3	10 mg/l	106	80.0-120	W46592	11Feb14 1141 by 308	12Feb14 0828 by 308		
	175147-3	10 mg/l	104	80.0-120	W46592	11Feb14 1141 by 308	12Feb14 0841 by 308		
	Relative Percent Difference:		1.14	25.0	W46592				

LABORATORY BLANK RESULTS

Analyte	Result	RL	PQL	QC Sample	Preparation Date	Analysis Date	Qual
Alkalinity as CaCO3	< 1 mg/l	1	1	W46508-1		03Feb14 0925 by 93	
Ammonia as N	< 0.1 mg/l	0.1	0.1	W46559-1		07Feb14 1252 by 93	
Carbonaceous BOD 5-day	< 2 mg/l	2	2	W46491-1	31Jan14 0819 by 285	05Feb14 0847 by 285	
Total Organic Carbon	< 1 mg/l	1	1	W46592-1	11Feb14 1141 by 308	12Feb14 0723 by 308	
Total Suspended Solids	< 4 mg/l	4	4	W46519-1	04Feb14 0932 by 302	04Feb14 1627 by 302	
Zinc	< 2 ug/l	2	2	S36198-1	31Jan14 1300 by 305	31Jan14 1341 by 305	
Zinc	< 2 ug/l	2	2	S36199-1	31Jan14 0800 by 235	31Jan14 1510 by 305	
Zinc	< 0.002 mg/l	0.002	0.002	S36201-1	04Feb14 1157 by 305	04Feb14 1319 by 305	
Copper	< 1 ug/l	1	1	S36208-1	05Feb14 0929 by 305	05Feb14 1223 by 305	
Dissolved Organic Carbon	< 1 mg/l	1	1	W46592-1	11Feb14 1141 by 308	12Feb14 0723 by 308	
Total Recoverable Zinc	< 2 ug/l	2	2	S36198-1	31Jan14 1300 by 305	31Jan14 1341 by 305	
Total Recoverable Zinc	< 2 ug/l	2	2	S36199-1	31Jan14 0800 by 235	31Jan14 1510 by 305	
Total Recoverable Zinc	< 0.002 mg/l	0.002	0.002	S36201-1	04Feb14 1157 by 305	04Feb14 1319 by 305	
Total Recoverable Copper	< 1 ug/l	1	1	S36208-1	05Feb14 0929 by 305	05Feb14 1223 by 305	

Van Buren Study

3.0 CHEMICAL AND OTHER MEASUREMENTS

Effluent samples collected for each series of tests (including range-finding tests and definitive tests) will be analyzed for the parameters listed in Table 3.1. This parameter list includes routine NPDES permit parameters that are analyzed to document plant operating conditions.

Table 3.1. Analytical parameters for effluent sample and laboratory water used for WER testing.

Parameter	Analytical Method	Reporting Limit (mg/L)
Total Recoverable Copper *	EPA 200.8	0.006
Dissolved copper *	EPA 200.8	0.006
Total Recoverable Zn *	EPA 200.8	0.006
Dissolved Zn *	EPA 200.8	0.006
~~Fecal Coliform Bacteria**~~	SM 9221, 9222	10 CFU/100mL
Total ammonia	SM 4500 NH3-E	0.1
pH **	HydroLab meter	Not applicable
~~Dissolved Oxygen **~~	HydroLab meter	0.5
~~Temperature **~~	HydroLab meter	Not applicable
Total Organic Carbon *	EPA 415.1	1.0
Hardness*	EPA 130.0	1.0
Total Alkalinity*	EPA 310.0	10
Dissolved Organic Carbon *	EPA 415.1	1.0
TSS *	EPA 160.2	4.0
CBOD5 *	EPA 405.1	2.0

*Parameters also to be measured in laboratory water.
** Measured in effluent at the time of sample arrival to the laboratory.

Samples for the analysis of Zn will be collected from each concentration at the beginning and end of each 24-hour period. The sample for the end of a 24-hour period (and/or end of the test, as appropriate) for a particular test concentration will be collected by combining all four replicates into a single composite. A portion of the composite will then be filtered through a 0.45 μ membrane filter to be used for determining dissolved Zn concentration. The preserved Zn samples will be analyzed as a single batch at the end of the test. Analyses will be conducted only on those concentrations necessary for LC50 calculations.

AMERICAN INTERPLEX CORPORATION LABORATORIES

February 17, 2014

Test Results of Acute 48 hour Non-Renewal Biomonitoring Testing for

175094-1: Effluent Total Zn
175094-2: Synthetic Total Zn
175094-3: Effluent Total Zn
175094-4: Synthetic Total Zn

Prepared for:

Mr. Pat Downey
FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Prepared by:

AMERICAN INTERPLEX CORPORATION
8600 Kanis Road
Little Rock, AR 72204-2322

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Re: Acute 48 hour Non-Renewal Biomonitoring utilizing *Ceriodaphnia dubia*
Effluent Total Zn - Van Buren, AR
Client NPDES Permit No. AR0040967 AFIN#17-00062

Dear Mr. Pat Downey:

Please find attached the data for the water effects ratio study. The spiking solution utilized for the study was prepared from zinc sulfate. The tests were conducted at 25 +/- 1 C. The LC50 data presented here is derived from the calculated zinc concentrations and not from the measured zinc concentrations. It should be noted that the measured effluent concentration of zinc is 95 ug/L. The LC50 data is summarized below for your review.

Ceriodaphnia dubia

Analyte	Effluent	Synthetic Water
Zinc	102 ug/L	90.6 ug/L

Pimephales promelas

Analyte	Effluent	Synthetic Water
Zinc	594 ug/L	430 ug/L

If I can be of further assistance, please feel free to contact me.

AMERICAN INTERPLEX CORPORATION

John Overbey
Laboratory Director

PDF cc: FTN Associates, Ltd.
ATTN: Mr. Pat Downey
pjd@ftn-assoc.com

Dilution Water Samples: North Plant Effluent

Analysis	Result
Dissolved oxygen (mg/l)	9.0
pH (standard units)	6.7
Alkalinity (mg/l as CaCO3)	13
Hardness (mg/l as CaCO3)	43
Conductivity (umhos/cm)	300
Residual Chlorine (mg/l)	NA

Results Summary: Effluent Total Zn

Ceriodaphnia dubia

The *Ceriodaphnia dubia* test was conducted from January 31, 2014 at 1725 to February 2, 2014 at 1530.

Statistical analyses:

NOEC = 68.7ppb
LC50 = 102.4ppb

Concentration	24 hour % Survival	48 hour % Survival	
Control	100	100	
29.0ppb	100	100	
44.6ppb	100	100	
68.7ppb	100	90.0	
106ppb	90.0	55.0	*
162ppb	75.0	0.00	*
250ppb	50.0	0.00	*

*Significant difference compared to the control (p=0.05)

Ceriodaphnia dubia
Survival Data

Number of organisms per chamber: 5
Volume of test chamber: 30 ml
Age of organisms: <24 hours
Volume of test solution: 15 ml

Effluent Concentration		Number of Survivors 24 Hours	48 Hours	% Survival	CV %
Control	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
29.0ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
44.6ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
68.7ppb	rep. A	5	5	90.0	12.8
	rep. B	5	5		
	rep. C	5	4		
	rep. D	5	4		
106ppb	rep. A	4	3	55.0	18.2
	rep. B	4	3		
	rep. C	5	2		
	rep. D	5	3		
162ppb	rep. A	4	0	0.00	0.00
	rep. B	3	0		
	rep. C	4	0		
	rep. D	4	0		
250ppb	rep. A	2	0	0.00	0.00
	rep. B	3	0		
	rep. C	3	0		
	rep. D	2	0		

CV = Coefficient of variance = standard deviation X 100/mean

Ceriodaphnia dubia

Transformation of Data		Transform: Arc Sin(Square Root(Y))		
Group	Identification	Rep	Value	Transformed
1	Control	1	1.00000	1.34530
1	Control	2	1.00000	1.34530
1	Control	3	1.00000	1.34530
1	Control	4	1.00000	1.34530
2	29ppb	1	1.00000	1.34530
2	29ppb	2	1.00000	1.34530
2	29ppb	3	1.00000	1.34530
2	29ppb	4	1.00000	1.34530
3	44.6ppb	1	1.00000	1.34530
3	44.6ppb	2	1.00000	1.34530
3	44.6ppb	3	1.00000	1.34530
3	44.6ppb	4	1.00000	1.34530
4	68.7ppb	1	1.00000	1.34530
4	68.7ppb	2	1.00000	1.34530
4	68.7ppb	3	0.80000	1.10710
4	68.7ppb	4	0.80000	1.10710
5	106ppb	1	0.60000	0.88608
5	106ppb	2	0.60000	0.88608
5	106ppb	3	0.40000	0.68472
5	106ppb	4	0.60000	0.88608
6	162ppb	1	0.00000	0.22551
6	162ppb	2	0.00000	0.22551
6	162ppb	3	0.00000	0.22551
6	162ppb	4	0.00000	0.22551
7	250ppb	1	0.00000	0.22551
7	250ppb	2	0.00000	0.22551
7	250ppb	3	0.00000	0.22551
7	250ppb	4	0.00000	0.22551

Ceriodaphnia dubia

Shapiro - Wilk's Test for Normality	Transform: Arc Sin(Square Root(Y))
D = 0.08715	
W = 0.7222	
Critical W = 0.896	(alpha = 0.01, N = 28)
Critical W = 0.924	(alpha = 0.05, N = 28)

Data FAIL normality test (alpha = 0.01).

Steel's Many-One Rank Test — Transform: Arc Sin(Square Root(Y))

Ho:Control<Treatment

Group	Identification	Rank Sum	Critical Value	DF	Sig 0.05
1	Control				
2	29ppb	18.00	10.00	4.00	
3	44.6ppb	18.00	10.00	4.00	
4	68.7ppb	14.00	10.00	4.00	
5	106ppb	10.00	10.00	4.00	*
6	162ppb	10.00	10.00	4.00	*
7	250ppb	10.00	10.00	4.00	*

Critical values are 1 tailed (k=6)

Ceriodaphnia dubia

Probit Analysis for Calculating LC/EC Values

Concentration	Number Exposed	Number Responding	Observed Proportion Responding	Proportion Responding Adjusted for Controls	Predicted Proportion Responding
29	20	0	0	0	0
44.6	20	0	0	0	0.0006
68.7	20	2	0.1	0.1	0.0593
106	20	9	0.45	0.45	0.5545
162	20	20	1	1	0.9639
250	20	20	1	1	0.9998

Chi - Square for Heterogeneity (calculated) = 2.245
Chi - Square for Heterogeneity (tabular value at 0.05 level) = 9.488

Mu = 2.01
Sigma = 0.1109

Parameter	Estimate	Std. Error	Lower 95% Conf.	Upper 95% Conf.
Intercept	-13.12	3.536	-20.05	-6.191
Slope	9.016	1.755	5.576	12.46

Theoretical Spontaneous Response Rate = 0

Estimated LC/EC Values and Confidence Limits

LC/EC Point	Exposure Conc.	Lower 95% Conf.	Upper 95% Conf.
1	56.5	38.16	68.27
5	67.24	50.12	78.12
10	73.78	57.8	84.18
15	78.55	63.51	88.7
50	102.4	91.02	115
85	133.4	118.2	164.6
90	142	124.6	180.8
95	155.8	134.2	208.5
99	185.4	153.6	273.8

Chemical Data for
Ceriodaphnia dubia

Day 1		Control	29.0ppb	44.6ppb	68.7ppb	106ppb	162ppb	250ppb
DO, mg/l	Initial	9.0	8.4	7.7	7.9	7.8	8.2	8.1
DO, mg/l	Final	8.0	8.0	8.0	8.0	8.1	8.2	8.1
pH, su	Initial	6.7	6.8	7.0	7.0	7.0	7.0	6.9
pH, su	Final	7.1	7.1	7.1	7.1	7.2	7.2	7.2
Alkalinity, mg/l		13	NA	NA	NA	NA	NA	NA
Hardness, mg/l		43	NA	NA	NA	NA	NA	NA
Conductivity, umho/cm		300	300	300	300	300	300	300

Day 2		Control	29.0ppb	44.6ppb	68.7ppb	106ppb	162ppb	250ppb
DO, mg/l	Final	8.2	8.1	8.3	8.3	8.3	8.2	8.1
pH, su	Final	7.2	7.1	7.2	7.1	7.2	7.2	7.2

AMERICAN INTERPLEX CORPORATION LABORATORIES

CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

PAGE OF

Client: VAN BUREN MUNICIPAL UTILITIES

Project Reference: NORTH PLANT

Project Manager: CLYDE Hill

Sampled By: [signature]

PO No.:

AIC CONTROL NO: 175094

AIC PROPOSAL NO:

Carrier/Tracking No. Fed-X

Received Temperature C: 0.1C

AIC No.	Sample Identification	Date/Time Collected	GRAB	COMP	WATER	SOIL		NO OF BOTTLES	WET STUDY												Remarks
	NPE1	1/29-30/14 10:00-10:00 A		X	X			6	X												
																					Field pH calibration
		Container Type						P													on 1/30 @ 5:00a
		Preservative						NO													Buffer: 4-7-10

G = Glass P = Plastic V = VOA vials H = HCl to pH2 T = Sodium Thiosulfate
NO = none S = Sulfuric acid pH2 N = Nitric acid pH2 B = NaOH to pH12 Z = Zinc acetate

Turnaround Time Requested: (Please circle) NORMAL or EXPEDITED IN ____ DAYS

Expedited results requested by:

Who should AIC contact with questions: Clyde Hill / FTN

Phone: 479-719-6508 Fax:

Report Attention to: VBFred@aol.com / FTN

Report Address to:

Relinquished By:	Date/Time	Received By:	Date/Time
[signature] 11:12	1/30/14	FED EX @ 7977 6666 5616	1/30/14 11:12
Relinquished By:	Date/Time	Received in Lab By:	Date/Time
		[signature]	1-31-14 1135

Comments:

19-Oct-09

7977 6666 5616

FORM 0060

Control No. 175094-3

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Re: Acute 48 hour Non-Renewal Biomonitoring utilizing *Pimephales promelas* (Fathead Minnow)
Effluent Total Zn - North Plant- Van Buren, AR
Client NPDES Permit No. AR0040967 AFIN#17-00062

Dilution Water Samples: North Plant Effluent

Analysis	Result
Dissolved oxygen (mg/l)	9.1
pH (standard units)	6.7
Alkalinity (mg/l as CaCO3)	13
Hardness (mg/l as CaCO3)	43
Conductivity (umhos/cm)	300
Residual Chlorine (mg/l)	NA

Results Summary: Effluent Total Zn

Pimephales promelas

The *Pimephales promelas* test was conducted from January 31, 2014 at 1630 to February 2, 2014 at 1440.
Statistical analyses:
NOEC = 268ppb
LC50 = 593.9ppb

Concentration	24 hour % Survival	48 hour % Survival
Control	100	100
174ppb	100	100
268ppb	100	100
412ppb	95.0	65.0 *
634ppb	75.0	55.0 *
975ppb	40.0	15.0 *
1500ppb	30.0	0.00 *

*Significant difference compared to the control (p=0.05)

AMERICAN INTERPLEX CORPORATION LABORATORIES

Pimephales promelas
Survival Data

Number of organisms per chamber: 5
Volume of test chamber: 500 ml

Age of organisms: 7 days
Volume of test solution: 250 ml

Effluent Concentration		Number of Survivors 24 Hours	48 Hours	% Survival	CV %
Control	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
174ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
268ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
412ppb	rep. A	5	3	65.0	15.4
	rep. B	4	4		
	rep. C	5	3		
	rep. D	5	3		
634ppb	rep. A	4	3	55.0	18.2
	rep. B	4	3		
	rep. C	3	3		
	rep. D	4	2		
975ppb	rep. A	3	1	15.0	66.7
	rep. B	1	1		
	rep. C	2	0		
	rep. D	2	1		
1500ppb	rep. A	1	0	0.00	0.00
	rep. B	2	0		
	rep. C	2	0		
	rep. D	1	0		

CV = Coefficient of variance = standard deviation X 100/mean

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Pimephales promelas

Transformation of Data — Transform: Arc Sin(Square Root(Y))

Group	Identification	Rep	Value	Transformed
1	Control	1	1.00000	1.34530
1	Control	2	1.00000	1.34530
1	Control	3	1.00000	1.34530
1	Control	4	1.00000	1.34530
2	174ppb	1	1.00000	1.34530
2	174ppb	2	1.00000	1.34530
2	174ppb	3	1.00000	1.34530
2	174ppb	4	1.00000	1.34530
3	268ppb	1	1.00000	1.34530
3	268ppb	2	1.00000	1.34530
3	268ppb	3	1.00000	1.34530
3	268ppb	4	1.00000	1.34530
4	412ppb	1	0.60000	0.88608
4	412ppb	2	0.80000	1.10710
4	412ppb	3	0.60000	0.88608
4	412ppb	4	0.60000	0.88608
5	634ppb	1	0.60000	0.88608
5	634ppb	2	0.60000	0.88608
5	634ppb	3	0.60000	0.88608
5	634ppb	4	0.40000	0.68472
6	975ppb	1	0.20000	0.46365
6	975ppb	2	0.20000	0.46365
6	975ppb	3	0.00000	0.22551
6	975ppb	4	0.20000	0.46365
7	1500ppb	1	0.00000	0.22551
7	1500ppb	2	0.00000	0.22551
7	1500ppb	3	0.00000	0.22551
7	1500ppb	4	0.00000	0.22551

Pimephales promelas

Shapiro - Wilk's Test for Normality	Transform: Arc Sin(Square Root(Y))
D = 0.1096	
W = 0.822	
Critical W = 0.896	(alpha = 0.01, N = 28)
Critical W = 0.924	(alpha = 0.05, N = 28)

Data FAIL normality test (alpha = 0.01).

Steel's Many-One Rank Test — Transform: Arc Sin(Square Root(Y))

Ho:Control<Treatment

Group	Identification	Rank Sum	Critical Value	DF	Sig 0.05
1	Control				
2	174ppb	18.00	10.00	4.00	
3	268ppb	18.00	10.00	4.00	
4	412ppb	10.00	10.00	4.00	*
5	634ppb	10.00	10.00	4.00	*
6	975ppb	10.00	10.00	4.00	*
7	1500ppb	10.00	10.00	4.00	*

Critical values are 1 tailed (k=6)

Pimephales promelas

Probit Analysis for Calculating LC/EC Values

Concentration	Number Exposed	Number Responding	Observed Proportion Responding	Proportion Responding Adjusted for Controls	Predicted Proportion Responding
174	20	0	0	0	0.0029
268	20	0	0	0	0.0367
412	20	7	0.35	0.35	0.2052
634	20	9	0.45	0.45	0.5584
975	20	17	0.85	0.85	0.8677
1500	20	20	1	1	0.9815

Chi - Square for Heterogeneity (calculated) = 4.773
Chi - Square for Heterogeneity (tabular value at 0.05 level) = 9.488

Mu = 2.774
Sigma = 0.193

Parameter	Estimate	Std. Error	Lower 95% Conf.	Upper 95% Conf.
Intercept	-9.373	2.206	-13.7	-5.05
Slope	5.182	0.7941	3.625	6.738

Theoretical Spontaneous Response Rate = 0

Estimated LC/EC Values and Confidence Limits

LC/EC Point	Exposure Conc.	Lower 95% Conf.	Upper 95% Conf.
1	211.2	131.8	276.4
5	286	200.8	352.9
10	336.1	250.4	403.5
15	374.7	289.9	442.8
50	593.9	511.5	690.7
85	941.3	794.9	1223
90	1050	872	1417
95	1234	996.7	1768
99	1670	1272	2695

Chemical Data for
Pimephales promelas

Day 1		Control	174ppb	268ppb	412ppb	634ppb	975ppb	1500ppb
DO, mg/l	Initial	9.1	8.4	8.3	8.2	8.0	8.4	8.5
DO, mg/l	Final	7.7	7.8	7.9	8.1	7.8	7.8	7.9
pH, su	Initial	6.7	6.8	6.8	6.9	6.8	6.8	6.8
pH, su	Final	7.3	7.2	7.2	7.2	7.2	7.2	7.2
Alkalinity, mg/l		13	NA	NA	NA	NA	NA	NA
Hardness, mg/l		43	NA	NA	NA	NA	NA	NA
Conductivity, umho/cm		300	300	300	300	300	300	310

Day 2		Control	174ppb	268ppb	412ppb	634ppb	975ppb	1500ppb
DO, mg/l	Final	7.8	7.8	8.1	8.2	8.0	7.9	8.0
pH, su	Final	7.2	7.1	7.2	7.2	7.1	7.1	7.1

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Re: Acute 48 hour Non-Renewal Biomonitoring utilizing *Pimephales promelas* (Fathead Minnow)
Synthetic Total Zn - North Plant- Van Buren, AR
Client NPDES Permit No. AR0040967 AFIN#17-00062

Dilution Water Samples: Synthetic Moderately Hard Water #4060

Analysis	Result
Dissolved oxygen (mg/l)	8.0
pH (standard units)	7.7
Alkalinity (mg/l as CaCO3)	58
Hardness (mg/l as CaCO3)	88
Conductivity (umhos/cm)	320
Residual Chlorine (mg/l)	<0.05

Results Summary: Synthetic Total Zn

Pimephales promelas

The *Pimephales promelas* test was conducted from January 31, 2014 at 1600 to February 2, 2014 at 1430.
Statistical analyses:
NOEC = 268ppb
LC50 = 430.3ppb

Concentration	24 hour % Survival	48 hour % Survival
Control	100	100
174ppb	100	100
268ppb	100	95.0
412ppb	50.0	35.0 *
634ppb	30.0	15.0 *
975ppb	20.0	10.0 *
1500ppb	25.0	0.00 *

*Significant difference compared to the control (p=0.05)

Pimephales promelas
Survival Data

Number of organisms per chamber: 5
Volume of test chamber: 500 ml
Age of organisms: 7 days
Volume of test solution: 250 ml

Effluent Concentration		Number of Survivors 24 Hours	48 Hours	% Survival	CV %
Control	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
174ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
268ppb	rep. A	5	5	95.0	10.5
	rep. B	5	4		
	rep. C	5	5		
	rep. D	5	5		
412ppb	rep. A	2	1	35.0	28.6
	rep. B	3	2		
	rep. C	3	2		
	rep. D	2	2		
634ppb	rep. A	3	1	15.0	66.7
	rep. B	0	0		
	rep. C	1	1		
	rep. D	2	1		
975ppb	rep. A	1	1	10.0	115
	rep. B	1	0		
	rep. C	1	0		
	rep. D	1	1		
1500ppb	rep. A	1	0	0.00	0.00
	rep. B	1	0		
	rep. C	2	0		
	rep. D	1	0		

CV = Coefficient of variance = standard deviation X 100/mean

Pimephales promelas

		Transformation of Data		Transform: Arc Sin(Square Root(Y))
Group	Identification	Rep	Value	Transformed
1	Control	1	1.00000	1.34530
1	Control	2	1.00000	1.34530
1	Control	3	1.00000	1.34530
1	Control	4	1.00000	1.34530
2	174ppb	1	1.00000	1.34530
2	174ppb	2	1.00000	1.34530
2	174ppb	3	1.00000	1.34530
2	174ppb	4	1.00000	1.34530
3	268ppb	1	1.00000	1.34530
3	268ppb	2	0.80000	1.10710
3	268ppb	3	1.00000	1.34530
3	268ppb	4	1.00000	1.34530
4	412ppb	1	0.20000	0.46365
4	412ppb	2	0.40000	0.68472
4	412ppb	3	0.40000	0.68472
4	412ppb	4	0.40000	0.68472
5	634ppb	1	0.20000	0.46365
5	634ppb	2	0.00000	0.22551
5	634ppb	3	0.20000	0.46365
5	634ppb	4	0.20000	0.46365
6	975ppb	1	0.20000	0.46365
6	975ppb	2	0.00000	0.22551
6	975ppb	3	0.00000	0.22551
6	975ppb	4	0.20000	0.46365
7	1500ppb	1	0.00000	0.22551
7	1500ppb	2	0.00000	0.22551
7	1500ppb	3	0.00000	0.22551
7	1500ppb	4	0.00000	0.22551

Pimephales promelas

Shapiro - Wilk's Test for Normality	Transform: Arc Sin(Square Root(Y))
D = 0.1785	
W = 0.8247	
Critical W = 0.896	(alpha = 0.01, N = 28)
Critical W = 0.924	(alpha = 0.05, N = 28)

Data FAIL normality test (alpha = 0.01).

Steel's Many-One Rank Test — Transform: Arc Sin(Square Root(Y))

Ho:Control<Treatment

Group	Identification	Rank Sum	Critical Value	DF	Sig 0.05
1	Control				
2	174ppb	18.00	10.00	4.00	
3	268ppb	16.00	10.00	4.00	
4	412ppb	10.00	10.00	4.00	*
5	634ppb	10.00	10.00	4.00	*
6	975ppb	10.00	10.00	4.00	*
7	1500ppb	10.00	10.00	4.00	*

Critical values are 1 tailed (k=6)

Pimephales promelas

Probit Analysis for Calculating LC/EC Values

Concentration	Number Exposed	Number Responding	Observed Proportion Responding	Proportion Responding Adjusted for Controls	Predicted Proportion Responding
174	20	0	0	0	0.0181
268	20	1	0.05	0.05	0.1367
412	20	13	0.65	0.65	0.4599
634	20	17	0.85	0.85	0.8149
975	20	18	0.9	0.9	0.9707
1500	20	20	1	1	0.9981

Chi - Square for Heterogeneity (calculated) = 8.276
Chi - Square for Heterogeneity (tabular value at 0.05 level) = 9.488

Mu = 2.634
Sigma = 0.1878

Parameter	Estimate	Std. Error	Lower 95% Conf.	Upper 95% Conf.
Intercept	-9.027	2.182	-13.3	-4.752
Slope	5.326	0.8248	3.709	6.942

Theoretical Spontaneous Response Rate = 0

Estimated LC/EC Values and Confidence Limits

LC/EC Point	Exposure Conc.	Lower 95% Conf.	Upper 95% Conf.
1	157.4	98.1	205.6
5	211.3	148.1	260.6
10	247.3	183.8	296.7
15	274.9	212.2	324.7
50	430.3	370.8	498.7
85	673.6	571.6	867.9
90	749	625.8	1001
95	876.3	712.8	1243
99	1177	903.8	1875

Chemical Data for
Pimephales promelas

Day 1		Control	174ppb	268ppb	412ppb	634ppb	975ppb	1500ppb
DO, mg/l	Initial	8.0	7.9	7.7	7.9	7.9	7.8	7.8
DO, mg/l	Final	7.6	8.0	7.8	8.0	7.9	7.9	7.9
pH, su	Initial	7.7	7.7	7.7	7.7	7.7	7.6	7.6
pH, su	Final	7.8	7.9	7.9	7.9	7.9	7.9	7.9
Alkalinity, mg/l		58	NA	NA	NA	NA	NA	NA
Hardness, mg/l		88	NA	NA	NA	NA	NA	NA
Conductivity, umho/cm		320	320	320	320	320	320	320
Residual Chlorine, mg/l		<0.05	NA	NA	NA	NA	NA	NA

Day 2		Control	174ppb	268ppb	412ppb	634ppb	975ppb	1500ppb
DO, mg/l	Final	8.1	8.4	8.0	8.2	8.1	8.3	8.3
pH, su	Final	7.6	7.6	7.6	7.6	7.6	7.7	7.7

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Re: Acute 48 hour Non-Renewal Biomonitoring utilizing *Ceriodaphnia dubia*
Synthetic Total Zn
Client NPDES Permit No. AR0040967 AFIN#17-00062

Dilution Water Samples: Synthetic Moderately Hard Water #4060

Analysis	Result
Dissolved oxygen (mg/l)	7.9
pH (standard units)	7.8
Alkalinity (mg/l as CaCO3)	58
Hardness (mg/l as CaCO3)	88
Conductivity (umhos/cm)	320
Residual Chlorine (mg/l)	<0.05

Results Summary: Synthetic Total Zn

Ceriodaphnia dubia

The *Ceriodaphnia dubia* test was conducted from January 31, 2014 at 1700 to February 2, 2014 at 1540.
Statistical analyses:
NOEC = 44.6ppb
LC50 = 90.6ppb

Concentration	24 hour % Survival	48 hour % Survival
Control	100	100
29.0ppb	100	100
44.6ppb	100	100
68.7ppb	85.0	75.0 *
106ppb	50.0	40.0 *
162ppb	45.0	0.00 *
250ppb	35.0	0.00 *

*Significant difference compared to the control (p=0.05)

Ceriodaphnia dubia
Survival Data

Number of organisms per chamber: 5
Volume of test chamber: 30 ml

Age of organisms: <24 hours
Volume of test solution: 15 ml

Effluent Concentration		Number of Survivors		% Survival	CV %
		24 Hours	48 Hours		
Control	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
29.0ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
44.6ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
68.7ppb	rep. A	5	4	75.0	13.3
	rep. B	4	4		
	rep. C	5	4		
	rep. D	3	3		
106ppb	rep. A	3	2	40.0	0.00
	rep. B	2	2		
	rep. C	2	2		
	rep. D	3	2		
162ppb	rep. A	2	0	0.00	0.00
	rep. B	2	0		
	rep. C	3	0		
	rep. D	2	0		
250ppb	rep. A	2	0	0.00	0.00
	rep. B	1	0		
	rep. C	2	0		
	rep. D	2	0		

CV = Coefficient of variance = standard deviation X 100/mean

Ceriodaphnia dubia

		Transformation of Data	Transform: Arc Sin(Square Root(Y))	
Group	Identification	Rep	Value	Transformed
1	Control	1	1.00000	1.34530
1	Control	2	1.00000	1.34530
1	Control	3	1.00000	1.34530
1	Control	4	1.00000	1.34530
2	29ppb	1	1.00000	1.34530
2	29ppb	2	1.00000	1.34530
2	29ppb	3	1.00000	1.34530
2	29ppb	4	1.00000	1.34530
3	44.6ppb	1	1.00000	1.34530
3	44.6ppb	2	1.00000	1.34530
3	44.6ppb	3	1.00000	1.34530
3	44.6ppb	4	1.00000	1.34530
4	68.7ppb	1	0.80000	1.10710
4	68.7ppb	2	0.80000	1.10710
4	68.7ppb	3	0.80000	1.10710
4	68.7ppb	4	0.60000	0.88608
5	106ppb	1	0.40000	0.68472
5	106ppb	2	0.40000	0.68472
5	106ppb	3	0.40000	0.68472
5	106ppb	4	0.40000	0.68472
6	162ppb	1	0.00000	0.22551
6	162ppb	2	0.00000	0.22551
6	162ppb	3	0.00000	0.22551
6	162ppb	4	0.00000	0.22551
7	250ppb	1	0.00000	0.22551
7	250ppb	2	0.00000	0.22551
7	250ppb	3	0.00000	0.22551
7	250ppb	4	0.00000	0.22551

Ceriodaphnia dubia

Shapiro - Wilk's Test for Normality	Transform: Arc Sin(Square Root(Y))
D = 0.03664	
W = 0.4337	
Critical W = 0.896	(alpha = 0.01, N = 28)
Critical W = 0.924	(alpha = 0.05, N = 28)

Data FAIL normality test (alpha = 0.01).

Steel's Many-One Rank Test — Transform: Arc Sin(Square Root(Y))

Ho:Control<Treatment

Group	Identification	Rank Sum	Critical Value	DF	Sig 0.05
1	Control				
2	29ppb	18.00	10.00	4.00	
3	44.6ppb	18.00	10.00	4.00	
4	68.7ppb	10.00	10.00	4.00	*
5	106ppb	10.00	10.00	4.00	*
6	162ppb	10.00	10.00	4.00	*
7	250ppb	10.00	10.00	4.00	*

Critical values are 1 tailed (k=6)

Ceriodaphnia dubia

Probit Analysis for Calculating LC/EC Values

Concentration	Number Exposed	Number Responding	Observed Proportion Responding	Proportion Responding Adjusted for Controls	Predicted Proportion Responding
29	20	0	0	0	0.0001
44.6	20	0	0	0	0.0099
68.7	20	5	0.25	0.25	0.1816
106	20	12	0.6	0.6	0.6978
162	20	20	1	1	0.9722
250	20	20	1	1	0.9996

Chi - Square for Heterogeneity (calculated) = 2.318
Chi - Square for Heterogeneity (tabular value at 0.05 level) = 9.488

Mu = 1.957
Sigma = 0.132

Parameter	Estimate	Std. Error	Lower 95% Conf.	Upper 95% Conf.
Intercept	-9.83	2.662	-15.05	-4.612
Slope	7.578	1.356	4.92	10.24

Theoretical Spontaneous Response Rate = 0

Estimated LC/EC Values and Confidence Limits

LC/EC Point	Exposure Conc.	Lower 95% Conf.	Upper 95% Conf.
1	44.67	29.65	55.15
5	54.94	40.4	64.9
10	61.35	47.5	71
15	66.1	52.88	75.6
50	90.56	79.82	102.7
85	124.1	108.6	154.8
90	133.7	115.6	172.3
95	149.3	126.5	202.6
99	183.6	148.9	276

Chemical Data for
Ceriodaphnia dubia

Day 1		Control	29.0ppb	44.6ppb	68.7ppb	106ppb	162ppb	250ppb
DO, mg/l	Initial	7.9	8.0	7.9	7.8	7.8	8.4	8.5
DO, mg/l	Final	7.8	7.9	7.9	8.0	8.0	8.0	8.1
pH, su	Initial	7.8	7.8	7.8	7.8	7.8	6.8	6.8
pH, su	Final	7.9	7.8	7.9	7.9	7.9	7.9	7.9
Alkalinity, mg/l		58	NA	NA	NA	NA	NA	NA
Hardness, mg/l		88	NA	NA	NA	NA	NA	NA
Conductivity, umho/cm		320	310	310	310	310	300	310
Residual Chlorine, mg/l		<0.05	NA	NA	NA	NA	NA	NA

Day 2		Control	29.0ppb	44.6ppb	68.7ppb	106ppb	162ppb	250ppb
DO, mg/l	Final	7.9	8.3	8.2	8.3	8.3	8.4	8.2
pH, su	Final	7.7	7.8	7.8	7.8	7.8	7.8	7.8

Title: VanBuren 2nd Definitive WER: total
File: VB2DEFTO.IN   Transform: LOG 10 DOSE

Probit Analysis - not Using Smoothed Proportions

DOSE	NUMBER SUBJECTS	NUMBER OBSERVED	OBSERVED PROPORTION	PREDICTED PROPORTION
130.00	20	20	1.0000	0.9996
140.00	20	20	1.0000	0.9967
162.50	20	18	0.9000	0.9302
197.00	20	10	0.5000	0.4488
254.50	20	0	0.0000	0.0118
344.00	20	0	0.0000	0.0000

Est. Mu =   2.2878   Est. Sigma =   0.0521
sd =   0.0118   sd =   0.0106

Chi-Square lack of fit = 0.8041   Likelihood lack of fit = 1.0813
Table Chi-square = 13.2767   (alpha = 0.01, df = 4)
Table Chi-square =   9.4877   (alpha = 0.05, df = 4)

Title: VanBuren 2nd Definitive WER: total
File: VB2DEFTO.IN   Transform: LOG 10 DOSE

Probit EC Estimates
WITHOUT CONTROL DATA

POINT	EST. END POINT	95% CONFIDENCE LIMITS	
EC 1	146.7646	131.3164	164.0301
EC 5	159.2612	146.4797	173.1580
EC10	166.3523	154.9857	178.5526
EC20	175.3631	165.4115	185.9133
EC25	178.9128	169.3148	189.0549
EC30	182.1618	172.7487	192.0878
EC40	188.1795	178.7009	198.1608
EC50	193.9837	183.9127	204.6063
EC60	199.9670	188.7888	211.8071
EC70	206.5729	193.7069	220.2934
EC75	210.3242	196.3332	225.3121
EC80	214.5816	199.2006	231.1503
EC90	226.2048	206.5804	247.6934
EC95	236.2766	212.6093	262.5784
EC99	256.3948	224.0146	293.4555

Title: VanBuren 2nd Definitive WER: total
File: VB2DEFTO.IN   Transform: LOG 10 DOSE

Spearman - Karber Estimate

Estimated EC50: 196.7666   95% Confidence Interval: (186.4157, 207.6923)
[p1 = p2 true; Unconditional Variance] : (186.2101, 207.9217)
[p1 = p2 true; Conditional Variance   ] : (186.4157, 207.6923)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	CONTROL	1.0000	1.0000	1.6955
2	130.0	1.0000	1.0000	2.1139

3	140.0	1.0000	1.0000	2.1461
4	162.5	0.9000	0.9000	2.2109
5	197.0	0.5000	0.5000	2.2945
6	254.5	0.0000	0.0000	2.4057
7	344.0	0.0000	0.0000	2.5366

Title: VanBuren 2nd Definitive WER: total
File: VB2DEFTO.IN Transform: LOG 10 DOSE

Trimmed Spearman - Karber	Estimate	95% C.I.	UNCONDITIONAL 95% C.I.
10.00%	197.6093	(185.71,210.27)	(185.48,210.53)
20.00%	197.4568	(183.52,212.46)	(183.24,212.77)
HIGH CALC 10.00%	197.6093	(185.71,210.27)	(185.48,210.53)
LOW CALC 0.00%	196.7666	(186.42,207.69)	(186.21,207.92)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	CONTROL	1.0000	1.0000	1.6955
2	130.0	1.0000	1.0000	2.1139
3	140.0	1.0000	1.0000	2.1461
4	162.5	0.9000	0.9000	2.2109
5	197.0	0.5000	0.5000	2.2945
6	254.5	0.0000	0.0000	2.4057
7	344.0	0.0000	0.0000	2.5366

Title: VanBuren 2nd Definitive WER: Dissolved
File: VB2DEFDI.IN Transform: LOG 10 DOSE

Probit Analysis - not Using Smoothed Proportions

DOSE	NUMBER SUBJECTS	NUMBER OBSERVED	OBSERVED PROPORTION	PREDICTED PROPORTION
130.00	20	20	1.0000	0.9994
140.00	20	20	1.0000	0.9959
160.00	20	18	0.9000	0.9392
194.50	20	11	0.5500	0.4788
249.50	20	0	0.0000	0.0181
335.50	20	0	0.0000	0.0000

Est. Mu = 2.2861 Est. Sigma = 0.0530
sd = 0.0119 sd = 0.0104

Chi-Square lack of fit = 1.4055 Likelihood lack of fit = 1.7787
Table Chi-square = 13.2767 (alpha = 0.01, df = 4)
Table Chi-square = 9.4877 (alpha = 0.05, df = 4)

Title: VanBuren 2nd Definitive WER: Dissolved
File: VB2DEFDI.IN Transform: LOG 10 DOSE

Probit EC Estimates
WITHOUT CONTROL DATA

POINT	EST. END POINT	95% CONFIDENCE LIMITS	
EC 1	145.5046	130.5147	162.2161
EC 5	158.1164	145.6425	171.6586
EC10	165.2805	154.1264	177.2419
EC20	174.3916	164.5283	184.8462
EC25	177.9831	168.4283	188.0801
EC30	181.2714	171.8655	191.1921
EC40	187.3646	177.8474	197.3912
EC50	193.2448	183.1224	203.9268
EC60	199.3096	188.0967	211.1909
EC70	206.0091	193.1506	219.7236
EC75	209.8152	195.8620	224.7623
EC80	214.1362	198.8305	230.6202
EC90	225.9405	206.4999	247.2114
EC95	236.1777	212.7873	262.1393
EC99	256.6487	224.7175	293.1171

Title: VanBuren 2nd Definitive WER: Dissolved
File: VB2DEFDI.IN Transform: LOG 10 DOSE

Spearman - Karber Estimate

Estimated EC50: 196.0838 95% Confidence Interval: (185.9548, 206.7644)
[p1 = p2 true; Unconditional Variance] : (185.7534, 206.9886)
[p1 = p2 true; Conditional Variance] : (185.9548, 206.7644)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	CONTROL	1.0000	1.0000	1.6955
2	130.0	1.0000	1.0000	2.1139
3	140.0	1.0000	1.0000	2.1461
4	160.0	0.9000	0.9000	2.2041
5	194.5	0.5500	0.5500	2.2889
6	249.5	0.0000	0.0000	2.3971
7	335.5	0.0000	0.0000	2.5257

Title: VanBuren 2nd Definitive WER: Dissolved
File: VB2DEFDI.IN Transform: LOG 10 DOSE

Trimmed Spearman - Karber	Estimate	95% C.I.	UNCONDITIONAL 95% C.I.
10.00%	197.3589	(185.58,209.89)	(185.34,210.15)
20.00%	197.8673	(184.00,212.78)	(183.73,213.10)
HIGH CALC 10.00%	197.3589	(185.58,209.89)	(185.34,210.15)
LOW CALC 0.00%	196.0838	(185.95,206.76)	(185.75,206.99)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	CONTROL	1.0000	1.0000	1.6955
2	130.0	1.0000	1.0000	2.1139
3	140.0	1.0000	1.0000	2.1461
4	160.0	0.9000	0.9000	2.2041
5	194.5	0.5500	0.5500	2.2889
6	249.5	0.0000	0.0000	2.3971
7	335.5	0.0000	0.0000	2.5257

Title: VanBuren 2nd Definitive WER: lab total
File: VB2LABTO.IN Transform: LOG 10 DOSE

Probit Analysis - not Using Smoothed Proportions

DOSE	NUMBER SUBJECTS	NUMBER OBSERVED	OBSERVED PROPORTION	PREDICTED PROPORTION
13.50	20	20	1.0000	1.0000
45.80	20	20	1.0000	0.9882
69.00	20	15	0.7500	0.8204
106.50	20	8	0.4000	0.3055
165.50	20	0	0.0000	0.0252
250.00	20	0	0.0000	0.0005

Est. Mu = 1.9601 Est. Sigma = 0.1322
sd = 0.0260 sd = 0.0245

Chi-Square lack of fit = 2.2802 Likelihood lack of fit = 2.9330
Table Chi-square = 13.2767 (alpha = 0.01, df = 4)
Table Chi-square = 9.4877 (alpha = 0.05, df = 4)

Title: VanBuren 2nd Definitive WER: lab total
File: VB2LABTO.IN Transform: LOG 10 DOSE

Probit EC Estimates
WITHOUT CONTROL DATA

POINT	EST. END POINT	95% CONFIDENCE LIMITS	
EC 1	44.9246	34.0132	59.3363
EC 5	55.2839	44.7045	68.3671
EC10	61.7503	51.5603	73.9542
EC20	70.6012	60.9549	81.7740
EC25	74.2869	64.8011	85.1612
EC30	77.7604	68.3549	88.4602
EC40	84.4502	74.9246	95.1867
EC50	91.2223	81.1134	102.5911
EC60	98.5375	87.2392	111.2990
EC70	107.0147	93.6936	122.2297
EC75	112.0186	97.2406	129.0423
EC80	117.8664	101.1903	137.2907
EC90	134.7606	111.7386	162.5258
EC95	150.5230	120.7931	187.5701
EC99	185.2329	139.0892	246.6851

Title: VanBuren 2nd Definitive WER: lab total
File: VB2LABTO.IN Transform: LOG 10 DOSE

Spearman - Karber Estimate

Estimated EC50: 92.6608 95% Confidence Interval: (76.3116, 112.5126)
[p1 = p2 true; Unconditional Variance] : (81.7553, 105.0209)
[p1 = p2 true; Conditional Variance] : (48.1250, 178.4107)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	<6	0.9500	0.9833	0.9086
2	13.5	1.0000	0.9833	1.1303
3	45.8	1.0000	0.9833	1.6609
4	69.0	0.7500	0.7500	1.8388
5	106.5	0.4000	0.4000	2.0273
6	165.5	0.0000	0.0000	2.2188
7	250.0	0.0000	0.0000	2.3979

Title: VanBuren 2nd Definitive WER: lab total
File: VB2LABTO.IN Transform: LOG 10 DOSE

Trimmed Spearman - Karber	Estimate	95% C.I.	UNCONDITIONAL 95% C.I.
10.00%	93.7380	(80.04,109.78)	(80.82,108.71)
20.00%	94.5419	(79.54,112.37)	(80.10,111.58)
HIGH CALC 23.73%	94.7041	(79.37,113.00)	(79.84,112.33)
LOW CALC 0.00%	92.6608	(80.67,106.43)	(81.76,105.02)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	<6	0.9500	0.9833	0.9086
2	13.5	1.0000	0.9833	1.1303
3	45.8	1.0000	0.9833	1.6609
4	69.0	0.7500	0.7500	1.8388
5	106.5	0.4000	0.4000	2.0273
6	165.5	0.0000	0.0000	2.2188
7	250.0	0.0000	0.0000	2.3979

Title: VanBuren 2nd Definitive WER: lab dissolved
File: VB2LABDI.IN Transform: LOG 10 DOSE

Probit Analysis - not Using Smoothed Proportions

DOSE	NUMBER SUBJECTS	NUMBER OBSERVED	OBSERVED PROPORTION	PREDICTED PROPORTION
32.90	20	20	1.0000	0.9997
45.50	20	20	1.0000	0.9906
69.80	20	15	0.7500	0.8164
105.50	20	8	0.4000	0.3103
164.50	20	0	0.0000	0.0229
247.00	20	0	0.0000	0.0004

Est. Mu = 1.9597 Est. Sigma = 0.1285
sd = 0.0254 sd = 0.0240

Chi-Square lack of fit = 2.0123 Likelihood lack of fit = 2.5933
Table Chi-square = 13.2767 (alpha = 0.01, df = 4)
Table Chi-square = 9.4877 (alpha = 0.05, df = 4)

Title: VanBuren 2nd Definitive WER: lab dissolved
File: VB2LABDI.IN Transform: LOG 10 DOSE

Probit EC Estimates
WITHOUT CONTROL DATA

POINT	EST. END POINT	95% CONFIDENCE LIMITS	
EC 1	45.7973	34.8924	60.1102
EC 5	56.0246	45.5324	68.9346
EC10	62.3800	52.3172	74.3783
EC20	71.0486	61.5719	81.9839
EC25	74.6490	65.3467	85.2754
EC30	78.0374	68.8271	88.4803
EC40	84.5513	75.2416	95.0130
EC50	91.1304	81.2597	102.2001
EC60	98.2214	87.1940	110.6434
EC70	106.4201	93.4252	121.2224
EC75	111.2507	96.8417	127.8037
EC80	116.8883	100.6402	135.7597
EC90	133.1316	110.7589	160.0234
EC95	148.2340	119.4181	184.0033
EC99	181.3373	136.8499	240.2868

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  ------------------------------------------------------------------------
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  Title:  VanBuren 2nd Definitive WER: lab dissolved
  File:      VB2LABDI.IN              Transform:                   LOG 10
DOSE

                            Spearman - Karber Estimate

     Estimated EC50:  92.4580    95% Confidence Interval: ( 79.0203,
108.1808)
             [ p1 = p2 true; Unconditional Variance ] : ( 81.7113,
104.6180)
             [ p1 = p2 true; Conditional Variance   ] : ( 48.5777,
175.9753)

                                           OBS       SMOOTH
    GROUP              IDENTIFICATION      PROP       PROP      DOSES
  ------------------------------------------------------------------------
-----
      1                            <6     0.9500     0.9833    1.1495
      2                          32.9     1.0000     0.9833    1.5172
      3                          45.5     1.0000     0.9833    1.6580
      4                          69.8     0.7500     0.7500    1.8439
      5                         105.5     0.4000     0.4000    2.0233
      6                         164.5     0.0000     0.0000    2.2162
      7                         247.0     0.0000     0.0000    2.3927
  ------------------------------------------------------------------------
-----
  Title:  VanBuren 2nd Definitive WER: lab dissolved
  File:      VB2LABDI.IN              Transform:                   LOG 10
DOSE

  Trimmed                                               UNCONDITIONAL
  Spearman - Karber   Estimate       95% C.I.              95% C.I.
  ------------------------------------------------------------------------
-----
            10.00%    93.5896    ( 80.10,109.36)    ( 80.89,108.29)
            20.00%    94.3807    ( 79.75,111.69)    ( 80.30,110.93)
  HIGH CALC 23.73%    94.5047    ( 79.64,112.15)    ( 80.09,111.51)
  LOW CALC   0.00%    92.4580    ( 80.60,106.05)    ( 81.71,104.62)

                                           OBS       SMOOTH
    GROUP              IDENTIFICATION      PROP       PROP      DOSES
  ------------------------------------------------------------------------
-----
      1                            <6     0.9500     0.9833     1.1495
      2                          32.9     1.0000     0.9833     1.5172
      3                          45.5     1.0000     0.9833     1.6580
      4                          69.8     0.7500     0.7500     1.8439
      5                         105.5     0.4000     0.4000     2.0233
      6                         164.5     0.0000     0.0000     2.2162
      7                         247.0     0.0000     0.0000     2.3927
  ------------------------------------------------------------------------
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Title: VanBuren 2nd def zn P.promeas effluent: total
File: VB2ZPEFT.IN Transform: LOG 10 DOSE

Probit Analysis - not Using Smoothed Proportions

DOSE	NUMBER SUBJECTS	NUMBER OBSERVED	OBSERVED PROPORTION	PREDICTED PROPORTION
287.00	20	20	1.0000	0.9945
386.00	20	20	1.0000	0.9601
544.00	20	13	0.6500	0.7979
776.00	20	11	0.5500	0.4539
1125.00	20	3	0.1500	0.1337
1735.00	20	0	0.0000	0.0117

Est. Mu = 2.8711 Est. Sigma = 0.1624
sd = 0.0266 sd = 0.0256

Chi-Square lack of fit = 4.6819 Likelihood lack of fit = 5.4617
Table Chi-square = 13.2767 (alpha = 0.01, df = 4)
Table Chi-square = 9.4877 (alpha = 0.05, df = 4)

Title: VanBuren 2nd def zn P.promeas effluent: total
File: VB2ZPEFT.IN Transform: LOG 10 DOSE

Probit EC Estimates

WITHOUT CONTROL DATA

POINT	EST. END POINT	95% CONFIDENCE LIMITS	
EC 1	311.3810	234.0518	414.2593
EC 5	401.7521	323.5346	498.8795
EC10	460.2077	383.2305	552.6468
EC20	542.4915	467.6771	629.2741
EC25	577.4748	503.0930	662.8538
EC30	610.8092	536.2481	695.7376
EC40	675.9604	598.6673	763.2326
EC50	743.1245	658.9295	838.0777
EC60	816.9622	720.2101	926.7118
EC70	904.1024	786.7888	1038.9080
EC75	956.2913	824.3058	1109.4100
EC80	1017.9589	866.8516	1195.4068
EC90	1199.9672	984.2044	1463.0306
EC95	1374.5642	1088.8157	1735.3043
EC99	1773.4995	1309.4971	2401.9148

Title: VanBuren 2nd def zn P.promeas effluent: total
File: VB2ZPEFT.IN Transform: LOG 10 DOSE

Spearman - Karber Estimate

Estimated EC50: 745.8343 95% Confidence Interval: (658.3549, 844.9376)
[p1 = p2 true; Unconditional Variance] : (656.6793, 847.0936)
[p1 = p2 true; Conditional Variance] : (658.3549, 844.9376)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	CONTROL	1.0000	1.0000	2.0848
2	287.0	1.0000	1.0000	2.4579
3	386.0	1.0000	1.0000	2.5866
4	544.0	0.6500	0.6500	2.7356
5	776.0	0.5500	0.5500	2.8899
6	1125.0	0.1500	0.1500	3.0512
7	1735.0	0.0000	0.0000	3.2393

Title: VanBuren 2nd def zn P.promeas effluent: total
File: VB2ZPEFT.IN Transform: LOG 10 DOSE

Trimmed Spearman - Karber		Estimate	95% C.I.	UNCONDITIONAL 95% C.I.
	10.00%	737.4722	(637.86,852.64)	(635.97,855.17)
	20.00%	744.0820	(627.65,882.11)	(625.47,885.18)
HIGH CALC	35.00%	778.0958	(598.42,1011.72)	(595.22,1017.16)
LOW CALC	0.00%	745.8343	(658.35,844.94)	(656.68,847.09)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	CONTROL	1.0000	1.0000	2.0848
2	287.0	1.0000	1.0000	2.4579
3	386.0	1.0000	1.0000	2.5866
4	544.0	0.6500	0.6500	2.7356
5	776.0	0.5500	0.5500	2.8899
6	1125.0	0.1500	0.1500	3.0512
7	1735.0	0.0000	0.0000	3.2393

Title: VanBuren 2nd def zn P.promeas effluent: dissolved
File: VB2ZPEFD.IN Transform: LOG 10 DOSE

Probit Analysis - not Using Smoothed Proportions

DOSE	NUMBER SUBJECTS	NUMBER OBSERVED	OBSERVED PROPORTION	PREDICTED PROPORTION
280.00	20	20	1.0000	0.9939
384.50	20	20	1.0000	0.9552
533.00	20	13	0.6500	0.8060
785.50	20	11	0.5500	0.4494
1165.00	20	3	0.1500	0.1284
1710.00	20	0	0.0000	0.0172

Est. Mu = 2.8735 Est. Sigma = 0.1700
sd = 0.0277 sd = 0.0261

Chi-Square lack of fit = 5.4263 Likelihood lack of fit = 6.3346
Table Chi-square = 13.2767 (alpha = 0.01, df = 4)
Table Chi-square = 9.4877 (alpha = 0.05, df = 4)

Title: VanBuren 2nd def zn P.promeas effluent: dissolved
File: VB2ZPEFD.IN Transform: LOG 10 DOSE

Probit EC Estimates
WITHOUT CONTROL DATA

POINT	EST. END POINT	95% CONFIDENCE LIMITS	
EC 1	300.5743	224.3006	402.7850
EC 5	392.4898	314.1047	490.4360
EC10	452.4824	374.6094	546.5435
EC20	537.5321	460.9072	626.8956
EC25	573.8815	497.3427	662.1994
EC30	608.6146	531.5898	696.7999
EC40	676.7533	596.4575	767.8587
EC50	747.3220	659.6131	846.6935
EC60	825.2492	724.3795	940.1651
EC70	917.6417	795.3043	1058.7977
EC75	973.1802	835.4892	1133.5631
EC80	1038.9894	881.2248	1224.9985
EC90	1234.2803	1008.1457	1511.1385
EC95	1422.9418	1122.1018	1804.4382
EC99	1858.0767	1364.6236	2529.9644

Title: VanBuren 2nd def zn P.promeas effluent: dissolved

File: VB2ZPEFD.IN Transform: LOG 10 DOSE

Spearman - Karber Estimate

Estimated EC50: 750.5357 95% Confidence Interval: (659.9425, 853.5651)

[p1 = p2 true; Unconditional Variance] : (658.2107, 855.8109)

[p1 = p2 true; Conditional Variance] : (659.9425, 853.5651)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	CONTROL	1.0000	1.0000	2.0781
2	280.0	1.0000	1.0000	2.4472
3	384.5	1.0000	1.0000	2.5849
4	533.0	0.6500	0.6500	2.7267
5	785.5	0.5500	0.5500	2.8951
6	1165.0	0.1500	0.1500	3.0663
7	1710.0	0.0000	0.0000	3.2330

Title: VanBuren 2nd def zn P.promeas effluent: dissolved

File: VB2ZPEFD.IN Transform: LOG 10 DOSE

Trimmed Spearman - Karber		Estimate	95% C.I.	UNCONDITIONAL 95% C.I.
	10.00%	743.6859	(639.13,865.35)	(637.15,868.03)
	20.00%	750.0582	(626.11,898.54)	(623.80,901.87)
HIGH CALC	35.00%	786.3327	(591.99,1044.47)	(588.57,1050.54)
LOW CALC	0.00%	750.5357	(659.94,853.57)	(658.21,855.81)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	CONTROL	1.0000	1.0000	2.0781
2	280.0	1.0000	1.0000	2.4472
3	384.5	1.0000	1.0000	2.5849
4	533.0	0.6500	0.6500	2.7267
5	785.5	0.5500	0.5500	2.8951
6	1165.0	0.1500	0.1500	3.0663
7	1710.0	0.0000	0.0000	3.2330

Title: VanBuren 2nd def zn P.promeas lab: total
File: VB2ZPLAT.IN Transform: LOG 10 DOSE

Probit Analysis - not Using Smoothed Proportions

DOSE	NUMBER SUBJECTS	NUMBER OBSERVED	OBSERVED PROPORTION	PREDICTED PROPORTION
178.00	20	20	1.0000	0.9837
276.00	20	19	0.9500	0.8669
425.00	20	7	0.3500	0.5409
665.50	20	3	0.1500	0.1722
978.50	20	2	0.1000	0.0324
1475.00	20	0	0.0000	0.0025

Est. Mu = 2.6475 Est. Sigma = 0.1858
sd = 0.0313 sd = 0.0283

Chi-Square lack of fit = 7.4977 Likelihood lack of fit = 7.1969
Table Chi-square = 13.2767 (alpha = 0.01, df = 4)
Table Chi-square = 9.4877 (alpha = 0.05, df = 4)

Title: VanBuren 2nd def zn P.promeas lab: total
File: VB2ZPLAT.IN Transform: LOG 10 DOSE

Probit EC Estimates
WITHOUT CONTROL DATA

POINT	EST. END POINT	95% CONFIDENCE LIMITS	
EC 1	164.1462	116.3941	231.4890
EC 5	219.7116	168.2908	286.8438
EC10	256.6580	204.2394	322.5299
EC20	309.8091	256.8887	373.6314
EC25	332.7724	279.6502	395.9857
EC30	354.8412	301.3659	417.8053
EC40	398.4703	343.4168	462.3495
EC50	444.0870	385.5137	511.5596
EC60	494.9259	429.6506	570.1182
EC70	555.7789	478.6408	645.3488
EC75	592.6370	506.5338	693.3765
EC80	636.5638	538.3261	752.7286
EC90	768.3894	626.6994	942.1140
EC95	897.6007	706.3330	1140.6618
EC99	1201.4491	877.3119	1645.3440

Title: VanBuren 2nd def zn P.promeas lab: total
File: VB2ZPLAT.IN Transform: LOG 10
DOSE

Spearman - Karber Estimate

Estimated EC50: 433.0487 95% Confidence Interval: (379.8431,
493.7068)
[p1 = p2 true; Unconditional Variance] : (378.8274,
495.0306)
[p1 = p2 true; Conditional Variance] : (379.8431,
493.7068)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	CONTROL	1.0000	1.0000	1.9044
2	178.0	1.0000	1.0000	2.2504
3	276.0	0.9500	0.9500	2.4409
4	425.0	0.3500	0.3500	2.6284
5	665.5	0.1500	0.1500	2.8231
6	978.5	0.1000	0.1000	2.9906
7	1475.0	0.0000	0.0000	3.1688

Title: VanBuren 2nd def zn P.promeas lab: total
File: VB2ZPLAT.IN Transform: LOG 10
DOSE

Trimmed Spearman - Karber		Estimate	95% C.I.	UNCONDITIONAL 95% C.I.
	10.00%	408.3779	(352.97,472.48)	(351.92,473.89)
	20.00%	392.5716	(338.32,455.52)	(337.30,456.90)
HIGH CALC	5.00%	422.2814	(368.18,484.33)	(367.16,485.68)
LOW CALC	0.00%	433.0487	(379.84,493.71)	(378.83,495.03)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	CONTROL	1.0000	1.0000	1.9044
2	178.0	1.0000	1.0000	2.2504
3	276.0	0.9500	0.9500	2.4409
4	425.0	0.3500	0.3500	2.6284
5	665.5	0.1500	0.1500	2.8231
6	978.5	0.1000	0.1000	2.9906
7	1475.0	0.0000	0.0000	3.1688

Title: VanBuren 2nd def zn P.promeas lab: dissolved
File: VB2ZPLAD.IN Transform: LOG 10 DOSE

Probit Analysis - not Using Smoothed Proportions

DOSE	NUMBER SUBJECTS	NUMBER OBSERVED	OBSERVED PROPORTION	PREDICTED PROPORTION
177.50	20	20	1.0000	0.9865
273.00	20	19	0.9500	0.8748
420.50	20	7	0.3500	0.5335
651.00	20	3	0.1500	0.1602
906.50	20	2	0.1000	0.0351
1255.00	20	0	0.0000	0.0045

Est. Mu = 2.6386 Est. Sigma = 0.1761
sd = 0.0300 sd = 0.0265

Chi-Square lack of fit = 6.6006 Likelihood lack of fit = 6.4405
Table Chi-square = 13.2767 (alpha = 0.01, df = 4)
Table Chi-square = 9.4877 (alpha = 0.05, df = 4)

Title: VanBuren 2nd def zn P.promeas lab: dissolved
File: VB2ZPLAD.IN Transform: LOG 10 DOSE

Probit EC Estimates
WITHOUT CONTROL DATA

POINT	EST. END POINT	95% CONFIDENCE LIMITS	
EC 1	169.3911	122.1179	234.9644
EC 5	223.3115	173.0540	288.1646
EC10	258.7579	207.8388	322.1518
EC20	309.2939	258.2663	370.4033
EC25	330.9828	279.9264	391.3515
EC30	351.7533	300.5335	411.7025
EC40	392.6218	340.3243	452.9558
EC50	435.1032	380.0668	498.1093
EC60	482.1811	421.6689	551.3771
EC70	538.2033	467.7390	619.2829
EC75	571.9777	493.8958	662.4039
EC80	612.0871	523.6289	715.4888
EC90	731.6291	605.7989	883.5954
EC95	847.7609	679.2807	1058.0289
EC99	1117.6192	835.6045	1494.8132

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  -----------------------------------------------------------------------
-----
  Title:  VanBuren 2nd def zn P.promeas lab: dissolved
  File:      VB2ZPLAD.IN             Transform:                  LOG 10
DOSE

                            Spearman - Karber Estimate

     Estimated EC50: 422.5923    95% Confidence Interval: (373.2415,
478.4685)
             [ p1 = p2 true; Unconditional Variance ] : (372.2959,
479.6837)
             [ p1 = p2 true; Conditional Variance   ] : (373.2415,
478.4685)

                                        OBS       SMOOTH
    GROUP             IDENTIFICATION     PROP       PROP      DOSES
  -----------------------------------------------------------------------
-----
      1                      CONTROL     1.0000     1.0000    1.9017
      2                        177.5     1.0000     1.0000    2.2492
      3                        273.0     0.9500     0.9500    2.4362
      4                        420.5     0.3500     0.3500    2.6238
      5                        651.0     0.1500     0.1500    2.8136
      6                        906.5     0.1000     0.1000    2.9574
      7                       1255.0     0.0000     0.0000    3.0986
  -----------------------------------------------------------------------
-----
  Title:  VanBuren 2nd def zn P.promeas lab: dissolved
  File:      VB2ZPLAD.IN             Transform:                  LOG 10
DOSE

  Trimmed                                                UNCONDITIONAL
  Spearman - Karber   Estimate       95% C.I.               95% C.I.
  -----------------------------------------------------------------------
-----
            10.00%   402.4714    (349.82,463.05)    (348.82,464.37)
            20.00%   387.9696    (335.01,449.31)    (334.00,450.66)
  HIGH CALC  5.00%   414.3402    (363.78,471.93)    (362.82,473.18)
  LOW CALC   0.00%   422.5923    (373.24,478.47)    (372.30,479.68)

                                        OBS       SMOOTH
    GROUP             IDENTIFICATION     PROP       PROP      DOSES
  -----------------------------------------------------------------------
-----
      1                      CONTROL     1.0000     1.0000     1.9017
      2                        177.5     1.0000     1.0000     2.2492
      3                        273.0     0.9500     0.9500     2.4362
      4                        420.5     0.3500     0.3500     2.6238
      5                        651.0     0.1500     0.1500     2.8136
      6                        906.5     0.1000     0.1000     2.9574
      7                       1255.0     0.0000     0.0000     3.0986
  -----------------------------------------------------------------------
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```

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

This report contains the analytical results and supporting information for samples submitted on July 29, 2014. Attached please find a copy of the Chain of Custody and/or other documents received. Note that any remaining sample will be discarded two weeks from the original report date unless other arrangements are made.

This report is intended for the sole use of the client listed above. Assessment of the data requires access to the entire document.

This report has been reviewed by the Laboratory Director or a qualified designee.

John Overbey
Laboratory Director

This document has been distributed to the following:

PDF cc: FTN Associates, Ltd.
ATTN: Mr. Pat Downey
pjd@ftn-assoc.com

AMERICAN INTERPLEX CORPORATION LABORATORIES

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

SAMPLE INFORMATION

Project Description:
One (1) water sample(s) received on July 29, 2014
North Plant
Van Buren WER Study

Receipt Details:
A Chain of Custody was provided. The samples were delivered in one (1) ice chest.
Ice chest #1 was delivered with shipping documentation.

Each sample container was checked for proper labeling, including date and time sampled. Sample containers were reviewed for proper type, adequate volume, integrity, temperature, preservation, and holding times. Any exceptions are noted below:

Sample Identification:

Laboratory ID	Client Sample ID	Sampled Date/Time	Notes
181101-1	Mixed Effluent-CD-75ppb-Initial		
181101-2	Mixed Effluent-CD-48.8ppb-Initial		
181101-3	Mixed Effluent-CD-31.7ppb-Initial		
181101-4	Mixed Effluent-CD-20.6ppb-Initial		
181101-5	Mixed Effluent-CD-13.4ppb-Initial		
181101-6	Mixed Effluent-CD-8.70ppb-Initial		
181101-7	Mixed Effluent-CD-5.66ppb-Initial		
181101-8	Synthetic MOD-CD-400ppb-Initial		
181101-9	Synthetic MOD-CD-260ppb-Initial		
181101-10	Synthetic MOD-CD-169ppb-Initial		
181101-11	Synthetic MOD-CD-110ppb-Initial		
181101-12	Synthetic MOD-CD-71.4ppb-Initial		
181101-13	Synthetic MOD-CD-46.4ppb-Initial		
181101-14	Mixed Effluent-CD-75ppb-Final		
181101-15	Mixed Effluent-CD-48.8ppb-Final		
181101-16	Mixed Effluent-CD-31.7ppb-Final		
181101-17	Mixed Effluent-CD-20.6ppb-Final		
181101-18	Mixed Effluent-CD-13.4ppb-Final		
181101-19	Mixed Effluent-CD-8.70ppb-Final		
181101-20	Mixed Effluent-CD-5.66ppb-Final		
181101-21	Synthetic MOD-CD-400ppb-Final		
181101-22	Synthetic MOD-CD-260ppb-Final		
181101-23	Synthetic MOD-CD-169ppb-Final		
181101-24	Synthetic MOD-CD-110ppb-Final		
181101-25	Synthetic MOD-CD-71.4ppb-Final		
181101-26	Synthetic MOD-CD-46.4ppb-Final		

Case Narrative:
There were no qualifiers for this data and all samples met quality control criteria.

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Little Rock, AR 72211

SAMPLE INFORMATION

References:
"Methods for Chemical Analysis of Water and Wastes", EPA/600/4-79-020 (Mar 1983) with updates and supplements EPA/600/5-91-010 (Jun 1991), EPA/600/R-92-129 (Aug 1992) and EPA/600/R-93-100 (Aug 1993).
"Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846)", Third Edition.
"Standard Methods for the Examination of Water and Wastewaters", (SM).
"American Society for Testing and Materials" (ASTM).
"Association of Analytical Chemists" (AOAC).

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ANALYTICAL RESULTS

AIC No. 181101-1
Sample Identification: Mixed Effluent-CD-75ppb-Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**75.8**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 29-Jul-2014 1620 by 235		Batch: S37144	
Dissolved Zinc		**59.7**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 29-Jul-2014 1617 by 235		Batch: S37144	

AIC No. 181101-2
Sample Identification: Mixed Effluent-CD-48.8ppb-Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**44.7**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 29-Jul-2014 1625 by 235		Batch: S37144	
Dissolved Zinc		**33.8**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 29-Jul-2014 1622 by 235		Batch: S37144	

AIC No. 181101-3
Sample Identification: Mixed Effluent-CD-31.7ppb-Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**27.8**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 29-Jul-2014 1630 by 235		Batch: S37144	
Dissolved Zinc		**18.3**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 29-Jul-2014 1628 by 235		Batch: S37144	

AIC No. 181101-4
Sample Identification: Mixed Effluent-CD-20.6ppb-Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**20.5**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 06-Aug-2014 1141 by 235		Batch: S37144	
Dissolved Zinc		**10.1**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 06-Aug-2014 1138 by 235		Batch: S37144	

AIC No. 181101-5
Sample Identification: Mixed Effluent-CD-13.4ppb-Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**14.3**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 06-Aug-2014 1146 by 235		Batch: S37144	
Dissolved Zinc		**6.23**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 06-Aug-2014 1143 by 235		Batch: S37144	

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ANALYTICAL RESULTS

AIC No. 181101-6
Sample Identification: Mixed Effluent-CD-8.70ppb-Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**10.9**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 06-Aug-2014 1035 by 235		Batch: S37144	
Dissolved Zinc		**4.84**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 06-Aug-2014 1033 by 235		Batch: S37144	

AIC No. 181101-7
Sample Identification: Mixed Effluent-CD-5.66ppb-Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**7.05**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 06-Aug-2014 1040 by 235		Batch: S37144	
Dissolved Zinc		**3.30**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 06-Aug-2014 1038 by 235		Batch: S37144	

AIC No. 181101-8
Sample Identification: Synthetic MOD-CD-400ppb-Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**418**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 29-Jul-2014 1703 by 235		Batch: S37144	
Dissolved Zinc		**418**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 29-Jul-2014 1700 by 235		Batch: S37144	

AIC No. 181101-9
Sample Identification: Synthetic MOD-CD-260ppb-Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**266**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 29-Jul-2014 1708 by 235		Batch: S37144	
Dissolved Zinc		**266**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 29-Jul-2014 1705 by 235		Batch: S37144	

AIC No. 181101-10
Sample Identification: Synthetic MOD-CD-169ppb-Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**171**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 29-Jul-2014 1719 by 235		Batch: S37144	
Dissolved Zinc		**175**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 29-Jul-2014 1716 by 235		Batch: S37144	

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ANALYTICAL RESULTS

AIC No. 181101-11
Sample Identification: Synthetic MOD-CD-110ppb-Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**110**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 29-Jul-2014 1724 by 235		Batch: S37144	
Dissolved Zinc		**111**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 29-Jul-2014 1721 by 235		Batch: S37144	

AIC No. 181101-12
Sample Identification: Synthetic MOD-CD-71.4ppb-Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**69.0**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 29-Jul-2014 1729 by 235		Batch: S37144	
Dissolved Zinc		**71.7**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 29-Jul-2014 1727 by 235		Batch: S37144	

AIC No. 181101-13
Sample Identification: Synthetic MOD-CD-46.4ppb-Initial

Analyte		Result	RL	Units	Qualifier
Zinc		**42.7**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 29-Jul-2014 1735 by 235		Batch: S37144	
Dissolved Zinc		**42.6**	2	**ug/l**	
EPA 200.7	Prep: 29-Jul-2014 1301 by 235	Analyzed: 29-Jul-2014 1732 by 235		Batch: S37144	

AIC No. 181101-14
Sample Identification: Mixed Effluent-CD-75ppb-Final

Analyte		Result	RL	Units	Qualifier
Zinc		**61.0**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 31-Jul-2014 1557 by 235		Batch: S37158	
Dissolved Zinc		**51.6**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 31-Jul-2014 1554 by 235		Batch: S37158	

AIC No. 181101-15
Sample Identification: Mixed Effluent-CD-48.8ppb-Final

Analyte		Result	RL	Units	Qualifier
Zinc		**39.0**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 31-Jul-2014 1602 by 235		Batch: S37158	
Dissolved Zinc		**31.5**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 31-Jul-2014 1559 by 235		Batch: S37158	

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ANALYTICAL RESULTS

AIC No. 181101-16
Sample Identification: Mixed Effluent-CD-31.7ppb-Final

Analyte		Result	RL	Units	Qualifier
Zinc		**23.7**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 31-Jul-2014 1607 by 235		Batch: S37158	
Dissolved Zinc		**21.3**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 31-Jul-2014 1605 by 235		Batch: S37158	

AIC No. 181101-17
Sample Identification: Mixed Effluent-CD-20.6ppb-Final

Analyte		Result	RL	Units	Qualifier
Zinc		**13.8**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 06-Aug-2014 1151 by 235		Batch: S37158	
Dissolved Zinc		**11.7**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 06-Aug-2014 1149 by 235		Batch: S37158	

AIC No. 181101-18
Sample Identification: Mixed Effluent-CD-13.4ppb-Final

Analyte		Result	RL	Units	Qualifier
Zinc		**9.57**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 06-Aug-2014 1156 by 235		Batch: S37158	
Dissolved Zinc		**7.66**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 06-Aug-2014 1154 by 235		Batch: S37158	

AIC No. 181101-19
Sample Identification: Mixed Effluent-CD-8.70ppb-Final

Analyte		Result	RL	Units	Qualifier
Zinc		**7.22**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 06-Aug-2014 1045 by 235		Batch: S37158	
Dissolved Zinc		**5.45**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 06-Aug-2014 1043 by 235		Batch: S37158	

AIC No. 181101-20
Sample Identification: Mixed Effluent-CD-5.66ppb-Final

Analyte		Result	RL	Units	Qualifier
Zinc		**5.17**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 06-Aug-2014 1051 by 235		Batch: S37158	
Dissolved Zinc		**4.07**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 06-Aug-2014 1048 by 235		Batch: S37158	

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ANALYTICAL RESULTS

AIC No. 181101-21
Sample Identification: Synthetic MOD-CD-400ppb-Final

Analyte		Result	RL	Units	Qualifier
Zinc		**464**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 31-Jul-2014 1638 by 235		Batch: S37158	
Dissolved Zinc		**462**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 31-Jul-2014 1636 by 235		Batch: S37158	

AIC No. 181101-22
Sample Identification: Synthetic MOD-CD-260ppb-Final

Analyte		Result	RL	Units	Qualifier
Zinc		**290**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 31-Jul-2014 1644 by 235		Batch: S37158	
Dissolved Zinc		**289**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 31-Jul-2014 1641 by 235		Batch: S37158	

AIC No. 181101-23
Sample Identification: Synthetic MOD-CD-169ppb-Final

Analyte		Result	RL	Units	Qualifier
Zinc		**189**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 31-Jul-2014 1654 by 235		Batch: S37158	
Dissolved Zinc		**187**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 31-Jul-2014 1651 by 235		Batch: S37158	

AIC No. 181101-24
Sample Identification: Synthetic MOD-CD-110ppb-Final

Analyte		Result	RL	Units	Qualifier
Zinc		**124**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 31-Jul-2014 1659 by 235		Batch: S37158	
Dissolved Zinc		**122**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 31-Jul-2014 1656 by 235		Batch: S37158	

AIC No. 181101-25
Sample Identification: Synthetic MOD-CD-71.4ppb-Final

Analyte		Result	RL	Units	Qualifier
Zinc		**81.3**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 31-Jul-2014 1704 by 235		Batch: S37158	
Dissolved Zinc		**81.7**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 31-Jul-2014 1702 by 235		Batch: S37158	

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ANALYTICAL RESULTS

AIC No. 181101-26
Sample Identification: Synthetic MOD-CD-46.4ppb-Final

Analyte		Result	RL	Units	Qualifier
Zinc		**51.7**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 31-Jul-2014 1710 by 235		Batch: S37158	
Dissolved Zinc		**51.2**	2	**ug/l**	
EPA 200.7	Prep: 31-Jul-2014 1520 by 235	Analyzed: 31-Jul-2014 1707 by 235		Batch: S37158	

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LABORATORY CONTROL SAMPLE RESULTS

Analyte	Spike Amount	%	Limits	RPD	Limit	Batch	Preparation Date	Analysis Date	Dil	Qual
Zinc	0.5 mg/l	98.2	85.0-115			S37144	29Jul14 1301 by 235	29Jul14 1601 by 235		
	0.5 mg/l	98.4	85.0-115	0.203	20.0	S37144	29Jul14 1301 by 235	29Jul14 1641 by 235		
Zinc	0.5 mg/l	105	85.0-115			S37158	31Jul14 1520 by 235	31Jul14 1538 by 235		
	0.5 mg/l	109	85.0-115	3.94	20.0	S37158	31Jul14 1520 by 235	31Jul14 1617 by 235		

LABORATORY BLANK RESULTS

Analyte	Result	RL	PQL	QC Sample	Preparation Date	Analysis Date	Qual
Zinc	< 2 ug/l	2	2	S37144-1	29Jul14 1301 by 235	29Jul14 1614 by 235	
Zinc	< 2 ug/l	2	2	S37158-1	31Jul14 1520 by 235	31Jul14 1552 by 235	

COPY

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CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

PAGE ___ OF ___

Client: VAN BUREN MUNICIPAL UTILITIES

Project Reference: NORTH PLANT

Project Manager: Clyde Hill

Sampled By: [signature]

PO No.:

AIC CONTROL NO: 181101

AIC PROPOSAL NO:

Carrier/Tracking No. Fed-X

Received Temperature C: 1.4

AIC No.	Sample Identification	Date/Time Collected	GRAB	COMP	WATER	SOIL		NO OF BOTTLES	EFFLUENT WER STUDY	Remarks
	NPE2	7/27-28/14 8:00-8:00am		X	X			3		pH 6.97
		Container Type						P		
		Preservative						NO		

ANALYSES REQUESTED

Field pH calibration on 7/28 @ [illegible]

Buffer: 4-7-10

G = Glass; P = Plastic (circled); NO = none (circled); S = Sulfuric acid pH2; V = VOA vials; N = Nitric acid pH2; H = HCl to pH2; B = NaOH to pH12; T = Sodium Thiosulfate; Z = Zinc acetate

Turnaround Time Requested: (Please circle) NORMAL or EXPEDITED IN ___ DAYS

Expedited results requested by: ______

Who should AIC contact with questions: Clyde Hill

Phone: 479-719-6508 Fax:

Report Attention to: JBFred@aol.com

Report Address to:

Relinquished By	Date/Time	Received By	Date/Time
[signature]	7/28/14 1107	FEDEX-G 7706 9744 2046	7/28/14 1107
Relinquished By:	Date/Time	Received In Lab By: [signature]	7-29-14 0930

Comments: 7706 9742 0604

19-Oct-09

FORM 0060

John Overbey

From: PJD <pjd@ftn-assoc.com>
Sent: Tuesday, July 29, 2014 9:35 AM
To: 'John Overbey'
Subject: RE: American Interplex

The effluent + receiving stream sample to spike needs to be 1.2% effluent.

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Pat Downey
Senior Project Manager
FTN Associates, Ltd.
3 Innwood Circle
Little Rock, AR 72211

tel 501-225-7779
fax 501-225-6738
cell 501-860-4447
pjd@ftn-assoc.com

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From: John Overbey [mailto:joverbey@americaninterplex.com]
Sent: Tuesday, July 29, 2014 10:41 AM
To: 'PJD'
Subject: American Interplex

Pat,

We have received the WER study

John Overbey
Laboratory Director
American Interplex Corporation
8600 Kanis Road
Little Rock, AR 72204
Direct 501 224 6401 ext. 209
Office 501 224 5060
fx 501 224 5072

AMERICAN INTERPLEX CORPORATION LABORATORIES

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

This report contains the analytical results and supporting information for samples submitted on July 29, 2014. Attached please find a copy of the Chain of Custody and/or other documents received. Note that any remaining sample will be discarded two weeks from the original report date unless other arrangements are made.

This report is intended for the sole use of the client listed above. Assessment of the data requires access to the entire document.

This report has been reviewed by the Laboratory Director or a qualified designee.

John Overbey
Laboratory Director

This document has been distributed to the following:

PDF cc: FTN Associates, Ltd.
ATTN: Mr. Pat Downey
pjd@ftn-assoc.com

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

SAMPLE INFORMATION

Project Description:
One (1) water and one (1) receiving water sample(s) received on July 29, 2014
North Plant
Van Buren WER Study

Receipt Details:
A Chain of Custody was provided. The samples were delivered in three (3) ice chests.
Ice chest #1 was delivered with shipping documentation.
Ice chest #2 was delivered with shipping documentation.
Ice chest #3 was delivered with shipping documentation.

Each sample container was checked for proper labeling, including date and time sampled. Sample containers were reviewed for proper type, adequate volume, integrity, temperature, preservation, and holding times. Any exceptions are noted below:

Sample Identification:

Laboratory ID	Client Sample ID	Sampled Date/Time	Notes
181102-1	Receiving Stream 7/28/14 8:30AM	28-Jul-2014 0830	
181102-2	Effluent 7/27-28/14 8:00-8:00AM	28-Jul-2014 0800	
181102-3	Mix Effluent (98% Receiving Stream 1.2% Efluent)		
181102-4	Mod Water		

Qualifiers:
H Analytical holding time exceeded regulatory requirements

Case Narrative:
Table II of 40 CFR Part 136.3 indicates analysis of pH, Total Residual Chlorine, and Dissolved Oxygen are to be performed on site or immediately after collection. American Interplex Corporation analyzes these parameters as soon as possible after laboratory receipt.

References:
"Methods for Chemical Analysis of Water and Wastes", EPA/600/4-79-020 (Mar 1983) with updates and supplements EPA/600/5-91-010 (Jun 1991), EPA/600/R-92-129 (Aug 1992) and EPA/600/R-93-100 (Aug 1993).
"Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846)", Third Edition.
"Standard Methods for the Examination of Water and Wastewaters", (SM).
"American Society for Testing and Materials" (ASTM).
"Association of Analytical Chemists" (AOAC).

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ANALYTICAL RESULTS

AIC No. 181102-1
Sample Identification: Receiving Stream 7/28/14 8:30AM

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**39**	1	**mg/l**	
SM 2320 B 1997		Analyzed: 29-Jul-2014 1221 by 93		Batch: W48643	
pH		**7.4**		**Units**	H
SM 4500-H+ B 2000		Analyzed: 29-Jul-2014 1222 by 93		Batch: W48640	
Ammonia as N		**< 0.1**	0.1	**mg/l**	
SM 4500-NH3 G 1997	Prep: 29-Jul-2014 1536 by 308	Analyzed: 30-Jul-2014 1015 by 308		Batch: W48639	
Carbonaceous BOD 5-day		**< 2**	2	**mg/l**	
SM 5210 B 2001	Prep: 29-Jul-2014 1445 by 313	Analyzed: 03-Aug-2014 1038 by 313		Batch: W48647	
Total Organic Carbon		**2.8**	1	**mg/l**	
SM 5310 C 2000	Prep: 30-Jul-2014 1518 by 308	Analyzed: 30-Jul-2014 2025 by 308		Batch: W48665	
Total Suspended Solids		**5.6**	4	**mg/l**	
USGS 3765	Prep: 30-Jul-2014 1511 by 271	Analyzed: 31-Jul-2014 1002 by 271		Batch: W48664	
Hardness as CaCO3		**35**	1	**mg/l**	
SM 2340 B 1997		Analyzed: 31-Jul-2014 1210 by 302		Batch: S37156	
Dissolved Organic Carbon		**1.7**	1	**mg/l**	
SM 5310 C 2000	Prep: 30-Jul-2014 1519 by 308	Analyzed: 30-Jul-2014 2217 by 302		Batch: W48665	
Dissolved Zinc		**< 2**	2	**ug/l**	
EPA 200.7	Prep: 04-Aug-2014 1105 by 311	Analyzed: 04-Aug-2014 1350 by 235		Batch: S37175	
Dissolved Copper		**< 1**	1	**ug/l**	
EPA 200.8	Prep: 31-Jul-2014 1210 by 311	Analyzed: 01-Aug-2014 1802 by 302		Batch: S37156	
Total Recoverable Zinc		**< 2**	2	**ug/l**	
EPA 200.7	Prep: 04-Aug-2014 1105 by 311	Analyzed: 04-Aug-2014 1352 by 235		Batch: S37175	
Total Recoverable Copper		**< 1**	1	**ug/l**	
EPA 200.8	Prep: 31-Jul-2014 1210 by 311	Analyzed: 01-Aug-2014 1802 by 302		Batch: S37156	

AIC No. 181102-2
Sample Identification: Effluent 7/27-28/14 8:00-8:00AM

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**45**	1	**mg/l**	
SM 2320 B 1997		Analyzed: 29-Jul-2014 1221 by 93		Batch: W48643	
pH		**7.3**		**Units**	H
SM 4500-H+ B 2000		Analyzed: 29-Jul-2014 1222 by 93		Batch: W48640	
Ammonia as N		**< 0.1**	0.1	**mg/l**	
SM 4500-NH3 G 1997	Prep: 29-Jul-2014 1536 by 308	Analyzed: 30-Jul-2014 1016 by 308		Batch: W48639	
Carbonaceous BOD 5-day		**< 2**	2	**mg/l**	
SM 5210 B 2001	Prep: 29-Jul-2014 1445 by 313	Analyzed: 03-Aug-2014 1043 by 313		Batch: W48647	
Total Organic Carbon		**6.4**	1	**mg/l**	
SM 5310 C 2000	Prep: 30-Jul-2014 1518 by 308	Analyzed: 30-Jul-2014 2039 by 308		Batch: W48665	
Total Suspended Solids		**< 4**	4	**mg/l**	
USGS 3765	Prep: 30-Jul-2014 1511 by 271	Analyzed: 31-Jul-2014 1002 by 271		Batch: W48664	

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ANALYTICAL RESULTS

AIC No. 181102-2 (Continued)
Sample Identification: Effluent 7/27-28/14 8:00-8:00AM

Analyte		Result	RL	Units	Qualifier
Hardness as CaCO3 SM 2340 B 1997		**53** Analyzed: 31-Jul-2014 1210 by 302	1	**mg/l** Batch: S37156	
Dissolved Organic Carbon SM 5310 C 2000	Prep: 30-Jul-2014 1519 by 308	**5.0** Analyzed: 30-Jul-2014 2230 by 302	1	**mg/l** Batch: W48665	
Dissolved Zinc EPA 200.7	Prep: 04-Aug-2014 1105 by 311	**91.2** Analyzed: 04-Aug-2014 1400 by 235	2	**ug/l** Batch: S37175	
Dissolved Copper EPA 200.8	Prep: 31-Jul-2014 1210 by 311	**3.60** Analyzed: 01-Aug-2014 1817 by 302	1	**ug/l** Batch: S37156	
Total Recoverable Zinc EPA 200.7	Prep: 04-Aug-2014 1105 by 311	**93.5** Analyzed: 04-Aug-2014 1403 by 235	2	**ug/l** Batch: S37175	
Total Recoverable Copper EPA 200.8	Prep: 31-Jul-2014 1210 by 311	**4.78** Analyzed: 01-Aug-2014 1817 by 302	1	**ug/l** Batch: S37156	

AIC No. 181102-3
Sample Identification: Mix Effluent (98% Receiving Stream 1.2% Efluent)

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3 SM 2320 B 1997		**40** Analyzed: 29-Jul-2014 1221 by 93	1	**mg/l** Batch: W48643	
pH SM 4500-H+ B 2000		**7.2** Analyzed: 29-Jul-2014 1222 by 93		**Units** Batch: W48640	
Ammonia as N SM 4500-NH3 G 1997	Prep: 29-Jul-2014 1536 by 308	**< 0.1** Analyzed: 30-Jul-2014 1018 by 308	0.1	**mg/l** Batch: W48639	
Carbonaceous BOD 5-day SM 5210 B 2001	Prep: 30-Jul-2014 0929 by 313	**< 2** Analyzed: 04-Aug-2014 0944 by 271	2	**mg/l** Batch: W48657	
Total Organic Carbon SM 5310 C 2000	Prep: 30-Jul-2014 1518 by 308	**2.9** Analyzed: 30-Jul-2014 2053 by 308	1	**mg/l** Batch: W48665	
Total Suspended Solids USGS 3765	Prep: 30-Jul-2014 1511 by 271	**< 4** Analyzed: 31-Jul-2014 1002 by 271	4	**mg/l** Batch: W48664	
Hardness as CaCO3 SM 2340 B 1997		**36** Analyzed: 31-Jul-2014 1210 by 302	1	**mg/l** Batch: S37156	
Dissolved Organic Carbon SM 5310 C 2000	Prep: 30-Jul-2014 1519 by 308	**1.7** Analyzed: 30-Jul-2014 2244 by 302	1	**mg/l** Batch: W48665	
Dissolved Zinc EPA 200.7	Prep: 04-Aug-2014 1105 by 311	**< 2** Analyzed: 04-Aug-2014 1406 by 235	2	**ug/l** Batch: S37175	
Dissolved Copper EPA 200.8	Prep: 31-Jul-2014 1210 by 311	**< 1** Analyzed: 01-Aug-2014 1821 by 302	1	**ug/l** Batch: S37156	
Total Recoverable Zinc EPA 200.7	Prep: 04-Aug-2014 1105 by 311	**< 2** Analyzed: 04-Aug-2014 1408 by 235	2	**ug/l** Batch: S37175	
Total Recoverable Copper EPA 200.8	Prep: 31-Jul-2014 1210 by 311	**1.04** Analyzed: 01-Aug-2014 1821 by 302	1	**ug/l** Batch: S37156	

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ANALYTICAL RESULTS

AIC No. 181102-4
Sample Identification: Mod Water

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3		**64**	1	**mg/l**	
SM 2320 B 1997		Analyzed: 29-Jul-2014 1221 by 93		Batch: W48643	
pH		**8.0**		**Units**	
SM 4500-H+ B 2000		Analyzed: 29-Jul-2014 1222 by 93		Batch: W48640	
Ammonia as N		**< 0.1**	0.1	**mg/l**	
SM 4500-NH3 G 1997	Prep: 29-Jul-2014 1536 by 308	Analyzed: 30-Jul-2014 1020 by 308		Batch: W48639	
Carbonaceous BOD 5-day		**< 2**	2	**mg/l**	
SM 5210 B 2001	Prep: 30-Jul-2014 0929 by 313	Analyzed: 04-Aug-2014 0947 by 271		Batch: W48657	
Total Organic Carbon		**1.7**	1	**mg/l**	
SM 5310 C 2000	Prep: 30-Jul-2014 1518 by 308	Analyzed: 30-Jul-2014 2106 by 308		Batch: W48665	
Total Suspended Solids		**< 4**	4	**mg/l**	
USGS 3765	Prep: 30-Jul-2014 1511 by 271	Analyzed: 31-Jul-2014 1002 by 271		Batch: W48664	
Hardness as CaCO3		**94**	1	**mg/l**	
SM 2340 B 1997		Analyzed: 31-Jul-2014 1210 by 302		Batch: S37156	
Dissolved Organic Carbon		**< 1**	1	**mg/l**	
SM 5310 C 2000	Prep: 30-Jul-2014 1519 by 308	Analyzed: 30-Jul-2014 2258 by 302		Batch: W48665	
Dissolved Zinc		**< 2**	2	**ug/l**	
EPA 200.7	Prep: 04-Aug-2014 1105 by 311	Analyzed: 04-Aug-2014 1411 by 235		Batch: S37175	
Dissolved Copper		**< 1**	1	**ug/l**	
EPA 200.8	Prep: 31-Jul-2014 1210 by 311	Analyzed: 01-Aug-2014 1833 by 302		Batch: S37156	
Total Recoverable Zinc		**< 2**	2	**ug/l**	
EPA 200.7	Prep: 04-Aug-2014 1105 by 311	Analyzed: 04-Aug-2014 1414 by 235		Batch: S37175	
Total Recoverable Copper		**< 1**	1	**ug/l**	
EPA 200.8	Prep: 31-Jul-2014 1210 by 311	Analyzed: 01-Aug-2014 1833 by 302		Batch: S37156	

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DUPLICATE RESULTS

Analyte		AIC No.	Result	RPD	RPD Limit	Preparation Date	Analysis Date	Dil	Qual
Total Recoverable Copper		181102-1	< 1 ug/l			31Jul14 1210 by 311	01Aug14 1802 by 302		
	Batch: S37156	Duplicate	< 1 ug/l	0.00		31Jul14 1210 by 311	01Aug14 1800 by 302		
Total Recoverable Zinc		181102-1	< 2 ug/l			04Aug14 1105 by 311	04Aug14 1352 by 235		
	Batch: S37175	Duplicate	< 2 ug/l	0.00		04Aug14 1106 by 311	04Aug14 1347 by 235		
pH		181088-1	7.2 Units				29Jul14 1116 by 93		H
	Batch: W48640	Duplicate	7.2 Units	0.140	5.00		29Jul14 1116 by 93		H
Alkalinity as CaCO3		181102-1	39 mg/l				29Jul14 1221 by 93		
	Batch: W48643	Duplicate	39 mg/l	1.28	20.0		29Jul14 1221 by 93		
Carbonaceous BOD 5-day		181102-1	< 2 mg/l			29Jul14 1445 by 313	03Aug14 1038 by 313		
	Batch: W48647	Duplicate	< 2 mg/l	0.00	20.0	29Jul14 1447 by 313	03Aug14 1040 by 313		
Carbonaceous BOD 5-day		181114-1	< 2 mg/l			30Jul14 0929 by 313	04Aug14 0959 by 271		
	Batch: W48657	Duplicate	< 2 mg/l	0.00	20.0	30Jul14 0929 by 313	04Aug14 1002 by 271		
Total Suspended Solids		181109-1	13 mg/l			30Jul14 1511 by 271	31Jul14 1002 by 271		
	Batch: W48664	Duplicate	13 mg/l	3.08	20.0	30Jul14 1512 by 271	31Jul14 1002 by 271		
Total Suspended Solids		181110-1	4.4 mg/l			30Jul14 1511 by 271	31Jul14 1002 by 271		
	Batch: W48664	Duplicate	4.0 mg/l	9.52	20.0	30Jul14 1512 by 271	31Jul14 1002 by 271		

LABORATORY CONTROL SAMPLE RESULTS

Analyte	Spike Amount	%	Limits	RPD	Limit	Batch	Preparation Date	Analysis Date	Dil	Qual
pH	-	99.7	98.0-102			W48640		29Jul14 1116 by 93		
Ammonia as N	1 mg/l	114	80.0-120			W48639	29Jul14 0958 by 308	29Jul14 1044 by 308		
Carbonaceous BOD 5-day	200 mg/l	94.4	84.5-115			W48647	29Jul14 1447 by 313	03Aug14 1031 by 308		
Carbonaceous BOD 5-day	200 mg/l	94.1	84.5-115			W48657	30Jul14 0929 by 313	04Aug14 0917 by 271		
Total Organic Carbon	10 mg/l	98.3	80.0-120			W48665	30Jul14 1519 by 308	30Jul14 1724 by 308		
Zinc	0.5 mg/l	101	85.0-115			S37175	04Aug14 1106 by 311	04Aug14 1331 by 235		
	0.5 mg/l	100	85.0-115	0.995	20.0	S37175	04Aug14 1106 by 311	04Aug14 1334 by 235		
Copper	0.05 mg/l	101	85.0-115			S37156	31Jul14 1210 by 311	01Aug14 1751 by 302		
	0.05 mg/l	104	85.0-115	2.99	20.0	S37156	31Jul14 1210 by 311	01Aug14 1756 by 302		
Total Recoverable Zinc	0.5 mg/l	101	85.0-115			S37175	04Aug14 1106 by 311	04Aug14 1331 by 235		
	0.5 mg/l	100	85.0-115	0.995	20.0	S37175	04Aug14 1106 by 311	04Aug14 1334 by 235		
Total Recoverable Copper	0.05 mg/l	101	85.0-115			S37156	31Jul14 1210 by 311	01Aug14 1751 by 302		
	0.05 mg/l	104	85.0-115	2.99	20.0	S37156	31Jul14 1210 by 311	01Aug14 1756 by 302		

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Little Rock, AR 72211

MATRIX SPIKE SAMPLE RESULTS

Analyte	Sample	Spike Amount	%	Limits	Batch	Preparation Date	Analysis Date	Dil	Qual
Ammonia as N	181088-2	1 mg/l	109	80.0-120	W48639	29Jul14 0958 by 308	29Jul14 1048 by 308		
	181088-2	1 mg/l	103	80.0-120	W48639	29Jul14 0958 by 308	29Jul14 1050 by 308		
	Relative Percent Difference:		3.84	25.0	W48639				
Total Organic Carbon	181130-1	10 mg/l	106	80.0-120	W48665	30Jul14 1519 by 308	30Jul14 1752 by 308		
	181130-1	10 mg/l	107	80.0-120	W48665	30Jul14 1519 by 308	30Jul14 1806 by 308		
	Relative Percent Difference:		1.12	25.0	W48665				

LABORATORY BLANK RESULTS

Analyte	Result	RL	PQL	QC Sample	Preparation Date	Analysis Date	Qual
Alkalinity as CaCO3	< 1 mg/l	1	1	W48643-1		29Jul14 1221 by 93	
Ammonia as N	< 0.1 mg/l	0.1	0.1	W48639-1	29Jul14 0958 by 308	29Jul14 1042 by 308	
Carbonaceous BOD 5-day	< 2 mg/l	2	2	W48647-1	29Jul14 1447 by 313	03Aug14 1030 by 308	
Carbonaceous BOD 5-day	< 2 mg/l	2	2	W48657-1	30Jul14 0929 by 313	04Aug14 0916 by 271	
Total Organic Carbon	< 1 mg/l	1	1	W48665-1	30Jul14 1519 by 308	30Jul14 1710 by 308	
Total Suspended Solids	< 4 mg/l	4	4	W48664-1	30Jul14 1512 by 271	31Jul14 1002 by 271	
Zinc	< 0.002 mg/l	0.002	0.002	S37175-1	04Aug14 1106 by 311	04Aug14 1328 by 235	
Copper	< 0.001 mg/l	0.001	0.001	S37156-1	31Jul14 1210 by 311	01Aug14 1749 by 302	
Total Recoverable Zinc	< 0.002 mg/l	0.002	0.002	S37175-1	04Aug14 1106 by 311	04Aug14 1328 by 235	
Total Recoverable Copper	< 0.001 mg/l	0.001	0.001	S37156-1	31Jul14 1210 by 311	01Aug14 1749 by 302	

AMERICAN INTERPLEX CORPORATION LABORATORIES

CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

Client: VAN BUREN MUNICIPAL UTILITIES

Project Reference: NORTH PLANT

Project Manager: CLYDE HILL

Sampled By: [signature]

PO No.:

AIC CONTROL NO: 181102

AIC PROPOSAL NO:

Carrier:/Tracking No.

Received Temperature C: 2.5

AIC No.	Sample Identification	Date/Time Collected	GRAB	COMP	WATER	SOIL		NO OF BOTTLES	RECEIVING WATER STUDY												Remarks
1	NPR102	7/28/14 8:30AM	X		X			3	X												pH 6.98
		Container Type						P													Field pH calibration on 7/28 @ 7:30
		Preservative						NO													Buffer: 4-7-10

G = Glass, P = Plastic, V = VOA vials, H = HCl to pH2, T = Sodium Thiosulfate
NO = none, S = Sulfuric acid pH2, N = Nitric acid pH2, B = NaOH to pH12, Z = Zinc acetate

Turnaround Time Requested: (Please circle)
NORMAL or EXPEDITED IN ____ DAYS
Expedited results requested by:
Who should AIC contact with questions: CLYDE HILL
Phone: 479-719-6508 Fax:
Report Attention to: VBFred@AOL.COM
Report Address to:

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	7/28/14 1107	FEDEX-G 7706 9746 3618	7/28/14 1109
Relinquished By:	Date/Time	Received in Lab By: [signature]	7/29/14 0930

Comments: 7706 9746 3618

19-Oct-09

FORM 0060

AMERICAN INTERPLEX CORPORATION LABORATORIES

CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

Client: VAN BOREN MONICIPAL UTILITIES
Project Reference: NORTH PLANT
Project Manager: CLYDE Hill
Sampled By: [signature]
PO No.:

AIC CONTROL NO: 181102
AIC PROPOSAL NO:
Carrier:/Tracking No.
Received Temperature C: 1.4

AIC No.	Sample Identification	Date/Time Collected	GRAB	COMP	WATER	SOIL		NO OF BOTTLES	EFFLUENT WER STUDY												Remarks
2	NPE2	7/27-28/14 8:00-8:00AM		X	X			3													pH 6.97
		Container Type						P													Field pH calibration on 7/28 @ 7:30
		Preservative						NO													Buffer: 4-7-10

ANALYSES REQUESTED[1]

G = Glass; NO = none; P = Plastic; S = Sulfuric acid pH2; V = VOA vials; N = Nitric acid pH2; H = HCl to pH2; B = NaOH to pH12; T = Sodium Thiosulfate; Z = Zinc acetate

Turnaround Time Requested: (Please circle)
NORMAL or EXPEDITED IN ____ DAYS
Expedited results requested by: ____
Who should AIC contact with questions: CLYDE HILL
Phone: 479-719-6508 Fax: ____
Report Attention to: VBFred@aol.com
Report Address to:

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	7/28/14 1107	FEDEX-G 7706 9744 8046	7/28/14 1107
Relinquished By:	Date/Time	Received in Lab By: [signature]	Date/Time 7/29/14 0930

Comments: 7706 9742 0604

19-Oct-09

FORM 0060

AMERICAN INTERPLEX CORPORATION LABORATORIES

CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

Client: VAN BUREN MUNICIPAL UTILITIES

Project Reference: NORTH PLANT

Project Manager: CLYDE HILL

Sampled By: [signature]

PO No.:

AIC CONTROL NO: 181102

AIC PROPOSAL NO:

Carrier:/Tracking No.

Received Temperature C: 1.4

ANALYSES REQUESTED[1]

AIC No.	Sample Identification	Date/Time Collected	GRAB	COMP	WATER	SOIL		NO OF BOTTLES	EFFLUENT / WER STUDY													Remarks
2	NPE 2	7/27-28/14 8:00-8:00 AM		X	X			3	X													pH 6.97
																						Field pH calibration
		Container Type						P														on 7/28 @ 7:30
		Preservative						NO														Buffer: 4 7 10

G = Glass   P = Plastic   V = VOA vials   H = HCl to pH2   T = Sodium Thiosulfate

NO = none   S = Sulfuric acid pH2   N = Nitric acid pH2   B = NaOH to pH12   Z = Zinc acetate

Turnaround Time Requested: (Please circle)
NORMAL or EXPEDITED IN ____ DAYS

Expedited results requested by:

Who should AIC contact with questions: CLYDE HILL

Phone: 479-719-6508   Fax:

Report Attention to: VBFred@aol.com

Report Address to:

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	7/28/14 11:07	FED EX-G 7706 9742 0604	7/28/14 11:07
Relinquished By:	Date/Time	Received in Lab By:	Date/Time
		[signature]	7/29/14 0930

Comments: 7706 9744 2046

19-Oct-09

FORM 0060

John Overbey

From: PJD <pjd@ftn-assoc.com>
Sent: Tuesday, July 29, 2014 9:35 AM
To: 'John Overbey'
Subject: RE: American Interplex

The effluent + receiving stream sample to spike needs to be 1.2% effluent.

.·´¯`·.¸¸.·´¯`·.. ><((((º>`·.¸¸.·´¯`·.¸.·´¯`·...¸><((((º>

Pat Downey
Senior Project Manager
FTN Associates, Ltd.
3 Innwood Circle
Little Rock, AR 72211

tel 501-225-7779
fax 501-225-6738
cell 501-860-4447
pjd@ftn-assoc.com
.·´¯`·.¸¸.·´¯`·.. ><((((º>`·.¸¸.·´¯`·.¸.·´¯`·...¸><((((º>

From: John Overbey [mailto:joverbey@americaninterplex.com]
Sent: Tuesday, July 29, 2014 10:41 AM
To: 'PJD'
Subject: American Interplex

Pat,

We have received the WER study

John Overbey
Laboratory Director
American Interplex Corporation
8600 Kanis Road
Little Rock, AR 72204
Direct 501 224 6401 ext. 209
Office 501 224 5060
fx 501 224 5072

August 7, 2014

Test Results of Acute 48 hour Non-Renewal Biomonitoring Testing for

181103-1: Mixed Effluent Total Zn
181103-2: Synthetic Mod Water Total Zn
181103-3: Mixed Effluent Dissolved Zn
181103-4: Synthetic Mod Water Dissolved Zn

Prepared for:

Mr. Pat Downey
FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Prepared by:

AMERICAN INTERPLEX CORPORATION
8600 Kanis Road
Little Rock, AR 72204-2322

AMERICAN INTERPLEX CORPORATION LABORATORIES

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Re: Acute 48 hour Non-Renewal Biomonitoring utilizing *Ceriodaphnia dubia*
Mixed Effluent Total Zn

Dear Mr. Pat Downey:

Please find attached the data for the water effects ratio study. The spiking solution utilized for the study was prepared from zinc sulfate. The tests were conducted at 25 +/- 1 C. The effluent was diluted with receiving water to create a 1.2% mixed effluent solution. The LC50 data presented here is derived from the measured zinc concentrations. The LC50 data is summarized below for your review.

Ceriodaphnia dubia

Analyte	**Effluent**	**Synthetic Water**
Zinc	23.5 ug/L	103 ug/L
Dissolved Zinc	13.2 ug/L	105 ug/L

If I can be of further assistance, please feel free to contact me.

AMERICAN INTERPLEX CORPORATION

John Overbey
Laboratory Director

PDF cc: FTN Associates, Ltd.
ATTN: Mr. Pat Downey
pjd@ftn-assoc.com

Dilution Water Samples: Mixed Effluent (98.8% Receiving + 1.2% Effluent)

Analysis	Result
Dissolved oxygen (mg/l)	7.8
pH (standard units)	7.5
Alkalinity (mg/l as CaCO3)	40
Hardness (mg/l as CaCO3)	36
Conductivity (umhos/cm)	86
Residual Chlorine (mg/l)	NA

Results Summary: Mixed Effluent Total Zn

Ceriodaphnia dubia

The *Ceriodaphnia dubia* test was conducted from July 29, 2014 at 1650 to July 31, 2014 at 1450.

Statistical analyses:

NOEC = 75.8ppb
LC50 = 23.5ppb

Concentration	24 hour % Survival	48 hour % Survival
Control	100	100
7.05ppb	100	100
10.9ppb	100	100
14.3ppb	100	100
20.5ppb	80.0	80.0
27.8ppb	60.0	15.0
44.7ppb	0.00	0.00
75.8ppb	0.00	0.00

Ceriodaphnia dubia
Survival Data

Number of organisms per chamber: 5 — Age of organisms: <24 hours
Volume of test chamber: 30 ml — Volume of test solution: 15 ml

Effluent Concentration		Number of Survivors 24 Hours	48 Hours	% Survival	CV %
Control	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
7.05ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
10.9ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
14.3ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
20.5ppb	rep. A	5	5	80.0	28.9
	rep. B	3	3		
	rep. C	3	3		
	rep. D	5	5		
27.8ppb	rep. A	4	1	15.0	66.7
	rep. B	2	0		
	rep. C	3	1		
	rep. D	3	1		
44.7ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		
75.8ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		

CV = Coefficient of variance = standard deviation X 100/mean

Ceriodaphnia dubia

Transformation of Data — Transform: Arc Sin(Square Root(Y))

Group	Identification	Rep	Value	Transformed
1	Control	1	1.00000	1.34530
1	Control	2	1.00000	1.34530
1	Control	3	1.00000	1.34530
1	Control	4	1.00000	1.34530
2	7.05ppb	1	1.00000	1.34530
2	7.05ppb	2	1.00000	1.34530
2	7.05ppb	3	1.00000	1.34530
2	7.05ppb	4	1.00000	1.34530
3	10.9ppb	1	1.00000	1.34530
3	10.9ppb	2	1.00000	1.34530
3	10.9ppb	3	1.00000	1.34530
3	10.9ppb	4	1.00000	1.34530
4	14.3ppb	1	1.00000	1.34530
4	14.3ppb	2	1.00000	1.34530
4	14.3ppb	3	1.00000	1.34530
4	14.3ppb	4	1.00000	1.34530
5	20.5ppb	1	1.00000	1.34530
5	20.5ppb	2	0.60000	0.88608
5	20.5ppb	3	0.60000	0.88608
5	20.5ppb	4	1.00000	1.34530
6	27.8ppb	1	0.20000	0.46365
6	27.8ppb	2	0.00000	0.22551
6	27.8ppb	3	0.20000	0.46365
6	27.8ppb	4	0.20000	0.46365
7	44.7ppb	1	0.00000	0.22551
7	44.7ppb	2	0.00000	0.22551
7	44.7ppb	3	0.00000	0.22551
7	44.7ppb	4	0.00000	0.22551
8	75.8ppb	1	0.00000	0.22551
8	75.8ppb	2	0.00000	0.22551
8	75.8ppb	3	0.00000	0.22551
8	75.8ppb	4	0.00000	0.22551

Ceriodaphnia dubia

Shapiro - Wilk's Test for Normality	Transform: Arc Sin(Square Root(Y))
D = 0.2534	
W = 0.6568	
Critical W = 0.904	(alpha = 0.01, N = 32)
Critical W = 0.93	(alpha = 0.05, N = 32)
Data FAIL normality test (alpha = 0.01).	

Steel's Many-One Rank Test — Transform: Arc Sin(Square Root(Y))

Ho:Control<Treatment

Group	Identification	Rank Sum	Critical Value	DF	Sig 0.05
1	Control				
2	7.05ppb	18.00	-1.00	4.00	
3	10.9ppb	18.00	-1.00	4.00	
4	14.3ppb	18.00	-1.00	4.00	
5	20.5ppb	14.00	-1.00	4.00	
6	27.8ppb	10.00	-1.00	4.00	
7	44.7ppb	10.00	-1.00	4.00	
8	75.8ppb	10.00	-1.00	4.00	

Critical values are 1 tailed (k=7)

Ceriodaphnia dubia

Probit Analysis for Calculating LC/EC Values

Concentration	Number Exposed	Number Responding	Observed Proportion Responding	Proportion Responding Adjusted for Controls	Predicted Proportion Responding
7.05	20	0	0	0	0
10.9	20	0	0	0	0
14.3	20	0	0	0	0.0009
20.5	20	4	0.2	0.2	0.1959
27.8	20	17	0.85	0.85	0.8523
44.7	20	20	1	1	1
75.8	20	20	1	1	1

Chi - Square for Heterogeneity (calculated) = 0.02256
Chi - Square for Heterogeneity (tabular value at 0.05 level) = 11.07

Mu = 1.371
Sigma = 0.06953

Parameter	Estimate	Std. Error	Lower 95% Conf.	Upper 95% Conf.
Intercept	-14.72	4.571	-23.68	-5.763
Slope	14.38	3.33	7.855	20.91

Theoretical Spontaneous Response Rate = 0

Estimated LC/EC Values and Confidence Limits

LC/EC Point	Exposure Conc.	Lower 95% Conf.	Upper 95% Conf.
1	16.2	11.72	18.47
5	18.07	14.23	20.03
10	19.15	15.75	20.95
15	19.92	16.84	21.63
50	23.51	21.66	25.53
85	27.76	25.56	32.87
90	28.87	26.38	35.15
95	30.6	27.59	38.91
99	34.12	29.91	47.25

Chemical Data for
Ceriodaphnia dubia

Day 1		Control	7.05ppb	10.9ppb	14.3ppb	20.5ppb	27.8ppb	44.7ppb	75.8ppb
DO, mg/l	Initial	7.8	8.1	8.0	8.0	8.2	8.2	8.2	8.1
DO, mg/l	Final	8.2	8.2	8.1	8.1	8.0	8.0	8.0	8.0
pH, su	Initial	7.5	7.5	7.5	7.5	7.5	7.5	7.4	7.5
pH, su	Final	7.2	7.2	7.2	7.2	7.2	7.2	7.3	7.3
Alkalinity, mg/l		40	NA	NA	NA	NA	NA	NA	NA
Hardness, mg/l		36	NA	NA	NA	NA	NA	NA	NA
Conductivity, umho/cm		86	86	86	86	87	86	86	86

Day 2		Control	7.05ppb	10.9ppb	14.3ppb	20.5ppb	27.8ppb	44.7ppb	75.8ppb
DO, mg/l	Final	7.6	7.6	7.6	7.5	7.6	9.0	8.8	8.9
pH, su	Final	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.3

COPY

AMERICAN INTERPLEX CORPORATION LABORATORIES

CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

Client: VAN BUREN MUNICIPAL UTILITIES

Project Reference: NORTH PLANT

Project Manager: CLYDE HILL

Sampled By: [signature]

PO No.

AIC CONTROL NO: 181103

AIC PROPOSAL NO:

Carrier/Tracking No.

Received Temperature C 2.5

AIC No.	Sample Identification	Date/Time Collected	GRAB	COMP	SAMPLE MATRIX: WATER	SAMPLE MATRIX: SOIL		NO OF BOTTLES	ANALYSES REQUESTED[1]: RECEIVING WATER STUDY												Remarks
1	NPR102	7/28/14 8:30AM	X		X			3	X												pH 6.98
		Container Type						P													Field pH calibration on 7/28 @ 7:31
		Preservative						NO													Buffer: 4-7-10

G = Glass
P = Plastic
V = VOA vials
H = HCl to pH2
T = Sodium Thiosulfate
NO = none
S = Sulfuric acid pH2
N = Nitric acid pH2
B = NaOH to pH12
Z = Zinc acetate

Turnaround Time Requested: (Please circle) NORMAL or EXPEDITED IN ____ DAYS

Expedited results requested by: ____

Who should AIC contact with questions: CLYDE HILL

Phone: 479-719-6508 Fax: ____

Report Attention to: VBFred@aol.com

Report Address to:

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	7/28/14 11:07	FEDEX-G 7706 9746 3618	7/28/14 11:09
		Received in Lab By: [signature]	7/29/14 0930

Comments: 7706 9746 3618

19-Oct-09

FORM 0060

AMERICAN INTERPLEX CORPORATION LABORATORIES

COPY

CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

Client: VAN BUREN MUNICIPAL UTILITIES
Project Reference: NORTH PLANT
Project Manager: CLYDE HILL
Sampled By: [signature]
PO No.:
AIC CONTROL NO: 181103
AIC PROPOSAL NO:
Carrier/Tracking No.:
Received Temperature C: 1.4

AIC No.	Sample Identification	Date/Time Collected	GRAB	COMP	WATER	SOIL		NO OF BOTTLES	EFFLUENT WER STUDY	Remarks
2	NPE2	7/27-28/14 8:00-8:00 AM		X	X			3	X	pH 6.97
		Container Type						P		
		Preservative						NO		

Field pH calibration on 7/28 @ 7:30
Buffer: 4 7 10

G = Glass, P = Plastic (circled), V = VOA vials, H = HCl to pH2, T = Sodium Thiosulfate
NO = none (circled), S = Sulfuric acid pH2, N = Nitric acid pH2, B = NaOH to pH12, Z = Zinc acetate

Turnaround Time Requested: (Please circle) NORMAL or EXPEDITED IN ____ DAYS
Expedited results requested by:
Who should AIC contact with questions: Clyde Hill
Phone: 479-719-6508 Fax:
Report Attention to: VBFred@aol.com
Report Address to:

Relinquished By	Date/Time	Received By	Date/Time
[signature]	7/28/14 11:07	FED EX-G 7706 9742 0604	7/28/14 11:07
		Received in Lab By: [signature]	7/29/14 0930

Comments: 7706 9744 2046

19-Oct-09

FORM 0060

AMERICAN INTERPLEX CORPORATION LABORATORIES

COPY

CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

Client: VAN BOREN MONICIPAL UTILITIES
Project Reference: NORTH PLANT
Project Manager: Clyde Hill
Sampled By: [signature]

PO No.:

AIC CONTROL NO: 181103
AIC PROPOSAL NO:
Carrier/Tracking No.:
Received Temperature C: 1.4

AIC No.	Sample Identification	Date/Time Collected	GRAB	COMP	WATER	SOIL		NO OF BOTTLES	EFFLUENT & WER STUD												Remarks
2	NPE2	7/27-28/14 8:00-8:00am		X	X			3													pH 6.97
		Container Type						P													
		Preservative						NO													

Field pH calibration on 7/28 @ 1130
Buffer: 4-7-10

G = Glass; P = Plastic; V = VOA vials; H = HCl to pH2; T = Sodium Thiosulfate
NO = none; S = Sulfuric acid pH2; N = Nitric acid pH2; B = NaOH to pH12; Z = Zinc acetate

Turnaround Time Requested: (Please circle)
NORMAL or EXPEDITED IN ____ DAYS
Expedited results requested by:
Who should AIC contact with questions: Clyde Hill
Phone: 479-719-6508 Fax:
Report Attention to: VBFred@aol.com
Report Address to:

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	7/28/14 1107	FEDEX-G 7706 9744 2046	7/28/14 1107
		Received In Lab By: [signature]	7/29/14 0830

Comments: 7706 9742 0604

19-Oct-09

FORM 0060

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Re: Acute 48 hour Non-Renewal Biomonitoring utilizing *Ceriodaphnia dubia*
Synthetic Mod Water Total Zn

Dilution Water Samples: Synthetic Moderately Hard Water #4117

Analysis	Result
Dissolved oxygen (mg/l)	8.1
pH (standard units)	7.8
Alkalinity (mg/l as CaCO3)	64
Hardness (mg/l as CaCO3)	94
Conductivity (umhos/cm)	290
Residual Chlorine (mg/l)	<0.05

Results Summary: Synthetic Mod Water Total Zn

Ceriodaphnia dubia

The *Ceriodaphnia dubia* test was conducted from July 29, 2014 at 1630 to July 31, 2014 at 1430.

Statistical analyses:

NOEC = 69ppb
LC50 = 103.1ppb

Concentration	24 hour % Survival	48 hour % Survival
Control	100	100
42.7ppb	100	100
69.0ppb	85.0	85.0
110ppb	90.0	55.0 *
171ppb	0.00	0.00 *
266ppb	0.00	0.00 *
418ppb	0.00	0.00 *

*Significant difference compared to the control (p=0.05)

Ceriodaphnia dubia
Survival Data

Number of organisms per chamber: 5
Volume of test chamber: 30 ml
Age of organisms: <24 hours
Volume of test solution: 15 ml

Effluent Concentration		Number of Survivors 24 Hours	48 Hours	% Survival	CV %
Control	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
42.7ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
69.0ppb	rep. A	5	5	85.0	22.5
	rep. B	5	5		
	rep. C	3	3		
	rep. D	4	4		
110ppb	rep. A	4	2	55.0	34.8
	rep. B	5	4		
	rep. C	5	3		
	rep. D	4	2		
171ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		
266ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		
418ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		

CV = Coefficient of variance = standard deviation X 100/mean

Ceriodaphnia dubia

Transformation of Data — Transform: Arc Sin(Square Root(Y))

Group	Identification	Rep	Value	Transformed
1	Control	1	1.00000	1.34530
1	Control	2	1.00000	1.34530
1	Control	3	1.00000	1.34530
1	Control	4	1.00000	1.34530
2	42.7ppb	1	1.00000	1.34530
2	42.7ppb	2	1.00000	1.34530
2	42.7ppb	3	1.00000	1.34530
2	42.7ppb	4	1.00000	1.34530
3	69ppb	1	1.00000	1.34530
3	69ppb	2	1.00000	1.34530
3	69ppb	3	0.60000	0.88608
3	69ppb	4	0.80000	1.10710
4	110ppb	1	0.40000	0.68472
4	110ppb	2	0.80000	1.10710
4	110ppb	3	0.60000	0.88608
4	110ppb	4	0.40000	0.68472
5	171ppb	1	0.00000	0.22551
5	171ppb	2	0.00000	0.22551
5	171ppb	3	0.00000	0.22551
5	171ppb	4	0.00000	0.22551
6	266ppb	1	0.00000	0.22551
6	266ppb	2	0.00000	0.22551
6	266ppb	3	0.00000	0.22551
6	266ppb	4	0.00000	0.22551
7	418ppb	1	0.00000	0.22551
7	418ppb	2	0.00000	0.22551
7	418ppb	3	0.00000	0.22551
7	418ppb	4	0.00000	0.22551

Ceriodaphnia dubia

Shapiro - Wilk's Test for Normality	Transform: Arc Sin(Square Root(Y))
D = 0.2677	
W = 0.7358	
Critical W = 0.896	(alpha = 0.01, N = 28)
Critical W = 0.924	(alpha = 0.05, N = 28)

Data FAIL normality test (alpha = 0.01).

Steel's Many-One Rank Test — Transform: Arc Sin(Square Root(Y))

Ho:Control<Treatment

Group	Identification	Rank Sum	Critical Value	DF	Sig 0.05
1	Control				
2	42.7ppb	18.00	10.00	4.00	
3	69ppb	14.00	10.00	4.00	
4	110ppb	10.00	10.00	4.00	*
5	171ppb	10.00	10.00	4.00	*
6	266ppb	10.00	10.00	4.00	*
7	418ppb	10.00	10.00	4.00	*

Critical values are 1 tailed (k=6)

Ceriodaphnia dubia

Probit Analysis for Calculating LC/EC Values

Concentration	Number Exposed	Number Responding	Observed Proportion Responding	Proportion Responding Adjusted for Controls	Predicted Proportion Responding
42.7	20	0	0	0	0.0018
69	20	3	0.15	0.15	0.0918
110	20	9	0.45	0.45	0.5843
171	20	20	1	1	0.9528
266	20	20	1	1	0.9991
418	20	20	1	1	1

Chi - Square for Heterogeneity (calculated) = 3.342
Chi - Square for Heterogeneity (tabular value at 0.05 level) = 9.488

Mu = 2.013
Sigma = 0.1313

Parameter	Estimate	Std. Error	Lower 95% Conf.	Upper 95% Conf.
Intercept	-10.33	2.85	-15.92	-4.747
Slope	7.616	1.409	4.854	10.38

Theoretical Spontaneous Response Rate = 0

Estimated LC/EC Values and Confidence Limits

LC/EC Point	Exposure Conc.	Lower 95% Conf.	Upper 95% Conf.
1	51.05	33.11	63.42
5	62.73	45.31	74.48
10	70.01	53.39	81.39
15	75.4	59.52	86.59
50	103.1	90.42	117.3
85	141.1	123.2	177.1
90	152	131.2	197.4
95	169.6	143.4	232.4
99	208.4	168.5	317.9

Chemical Data for
Ceriodaphnia dubia

Day 1		Control	42.7ppb	69.0ppb	110ppb	171ppb	266ppb	418ppb
DO, mg/l	Initial	8.1	8.3	8.2	8.2	8.3	8.2	8.1
DO, mg/l	Final	7.9	8.0	8.0	8.1	8.1	8.1	8.2
pH, su	Initial	7.8	7.8	7.8	7.8	7.8	7.8	7.8
pH, su	Final	7.7	7.7	7.7	7.7	7.7	7.7	7.7
Alkalinity, mg/l		64	NA	NA	NA	NA	NA	NA
Hardness, mg/l		94	NA	NA	NA	NA	NA	NA
Conductivity, umho/cm		290	280	280	280	280	280	280
Residual Chlorine, mg/l		<0.05	NA	NA	NA	NA	NA	NA

Day 2		Control	42.7ppb	69.0ppb	110ppb	171ppb	266ppb	418ppb
DO, mg/l	Final	8.7	8.8	8.7	8.6	8.6	8.5	8.6
pH, su	Final	7.7	7.7	7.7	7.7	7.7	7.7	7.7

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Re: Acute 48 hour Non-Renewal Biomonitoring utilizing *Ceriodaphnia dubia*
Mixed Effluent Dissolved Zn

Dilution Water Samples: Mixed Effluent (98.8% Receiving + 1.2% Effluent)

Analysis	Result
Dissolved oxygen (mg/l)	7.8
pH (standard units)	7.5
Alkalinity (mg/l as CaCO3)	40
Hardness (mg/l as CaCO3)	36
Conductivity (umhos/cm)	86
Residual Chlorine (mg/l)	NA

Results Summary: Mixed Effluent Dissolved Zn

Ceriodaphnia dubia

The *Ceriodaphnia dubia* test was conducted from July 29, 2014 at 1650 to July 31, 2014 at 1450.

Statistical analyses:
NOEC = 59.7ppb
LC50 = 13.2ppb

Concentration	24 hour % Survival	48 hour % Survival
Control	100	100
3.30ppb	100	100
4.84ppb	100	100
6.23ppb	100	100
10.1ppb	80.0	80.0
18.3ppb	60.0	15.0
33.8ppb	0.00	0.00
59.7ppb	0.00	0.00

AMERICAN INTERPLEX CORPORATION LABORATORIES

Ceriodaphnia dubia
Survival Data

Number of organisms per chamber: 5
Volume of test chamber: 30 ml

Age of organisms: <24 hours
Volume of test solution: 15 ml

Effluent Concentration		Number of Survivors 24 Hours	48 Hours	% Survival	CV %
Control	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
3.30ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
4.84ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
6.23ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
10.1ppb	rep. A	5	5	80.0	28.9
	rep. B	3	3		
	rep. C	3	3		
	rep. D	5	5		
18.3ppb	rep. A	4	1	15.0	66.7
	rep. B	2	0		
	rep. C	3	1		
	rep. D	3	1		
33.8ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		
59.7ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		

CV = Coefficient of variance = standard deviation X 100/mean

Ceriodaphnia dubia

Transformation of Data — Transform: Arc Sin(Square Root(Y))

Group	Identification	Rep	Value	Transformed
1	Control	1	1.00000	1.34530
1	Control	2	1.00000	1.34530
1	Control	3	1.00000	1.34530
1	Control	4	1.00000	1.34530
2	3.3ppb	1	1.00000	1.34530
2	3.3ppb	2	1.00000	1.34530
2	3.3ppb	3	1.00000	1.34530
2	3.3ppb	4	1.00000	1.34530
3	4.84ppb	1	1.00000	1.34530
3	4.84ppb	2	1.00000	1.34530
3	4.84ppb	3	1.00000	1.34530
3	4.84ppb	4	1.00000	1.34530
4	6.23ppb	1	1.00000	1.34530
4	6.23ppb	2	1.00000	1.34530
4	6.23ppb	3	1.00000	1.34530
4	6.23ppb	4	1.00000	1.34530
5	10.1ppb	1	1.00000	1.34530
5	10.1ppb	2	0.60000	0.88608
5	10.1ppb	3	0.60000	0.88608
5	10.1ppb	4	1.00000	1.34530
6	18.3ppb	1	0.20000	0.46365
6	18.3ppb	2	0.00000	0.22551
6	18.3ppb	3	0.20000	0.46365
6	18.3ppb	4	0.20000	0.46365
7	33.8ppb	1	0.00000	0.22551
7	33.8ppb	2	0.00000	0.22551
7	33.8ppb	3	0.00000	0.22551
7	33.8ppb	4	0.00000	0.22551
8	59.7ppb	1	0.00000	0.22551
8	59.7ppb	2	0.00000	0.22551
8	59.7ppb	3	0.00000	0.22551
8	59.7ppb	4	0.00000	0.22551

Ceriodaphnia dubia

Shapiro - Wilk's Test for Normality	Transform: Arc Sin(Square Root(Y))
D = 0.2534	
W = 0.6568	
Critical W = 0.904	(alpha = 0.01, N = 32)
Critical W = 0.93	(alpha = 0.05, N = 32)

Data FAIL normality test (alpha = 0.01).

Steel's Many-One Rank Test — Transform: Arc Sin(Square Root(Y))

Ho:Control<Treatment

Group	Identification	Rank Sum	Critical Value	DF	Sig 0.05
1	Control				
2	3.3ppb	18.00	-1.00	4.00	
3	4.84ppb	18.00	-1.00	4.00	
4	6.23ppb	18.00	-1.00	4.00	
5	10.1ppb	14.00	-1.00	4.00	
6	18.3ppb	10.00	-1.00	4.00	
7	33.8ppb	10.00	-1.00	4.00	
8	59.7ppb	10.00	-1.00	4.00	

Critical values are 1 tailed (k=7)

Ceriodaphnia dubia

Probit Analysis for Calculating LC/EC Values

Concentration	Number Exposed	Number Responding	Observed Proportion Responding	Proportion Responding Adjusted for Controls	Predicted Proportion Responding
3.3	20	0	0	0	0
4.84	20	0	0	0	0.0004
6.23	20	0	0	0	0.0056
10.1	20	4	0.2	0.2	0.1804
18.3	20	17	0.85	0.85	0.861
33.8	20	20	1	1	0.9992
59.7	20	20	1	1	1

Chi - Square for Heterogeneity (calculated) = 0.2076
Chi - Square for Heterogeneity (tabular value at 0.05 level) = 11.07

Mu = 1.122
Sigma = 0.1292

Parameter	Estimate	Std. Error	Lower 95% Conf.	Upper 95% Conf.
Intercept	-3.69	1.696	-7.014	-0.3652
Slope	7.743	1.513	4.777	10.71

Theoretical Spontaneous Response Rate = 0

Estimated LC/EC Values and Confidence Limits

LC/EC Point	Exposure Conc.	Lower 95% Conf.	Upper 95% Conf.
1	6.636	4.246	8.251
5	8.126	5.824	9.672
10	9.054	6.865	10.57
15	9.738	7.65	11.25
50	13.25	11.5	15.41
85	18.04	15.5	23.56
90	19.4	16.47	26.3
95	21.62	17.97	31.05
99	26.47	21.03	42.67

Chemical Data for
Ceriodaphnia dubia

Day 1		Control	3.30ppb	4.84ppb	6.23ppb	10.1ppb	18.3ppb	33.8ppb	59.7ppb
DO, mg/l	Initial	7.8	8.1	8.0	8.0	8.2	8.2	8.2	8.1
DO, mg/l	Final	8.2	8.2	8.1	8.1	8.0	8.0	8.0	8.0
pH, su	Initial	7.5	7.5	7.5	7.5	7.5	7.5	7.4	7.5
pH, su	Final	7.2	7.2	7.2	7.2	7.2	7.2	7.3	7.3
Alkalinity, mg/l		40	NA	NA	NA	NA	NA	NA	NA
Hardness, mg/l		36	NA	NA	NA	NA	NA	NA	NA
Conductivity, umho/cm		86	86	86	86	87	86	86	86

Day 2		Control	3.30ppb	4.84ppb	6.23ppb	10.1ppb	18.3ppb	33.8ppb	59.7ppb
DO, mg/l	Final	7.6	7.6	7.6	7.5	7.6	9.0	8.9	8.9
pH, su	Final	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.3

AMERICAN INTERPLEX CORPORATION LABORATORIES

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Re: Acute 48 hour Non-Renewal Biomonitoring utilizing *Ceriodaphnia dubia*
Synthetic Mod Water Dissolved Zn

Dilution Water Samples: Synthetic Moderately Hard Water #4117

Analysis	Result
Dissolved oxygen (mg/l)	8.1
pH (standard units)	7.8
Alkalinity (mg/l as CaCO3)	64
Hardness (mg/l as CaCO3)	94
Conductivity (umhos/cm)	290
Residual Chlorine (mg/l)	<0.05

Results Summary: Synthetic Mod Water Dissolved Zn
Ceriodaphnia dubia

The *Ceriodaphnia dubia* test was conducted from July 29, 2014 at 1630 to July 31, 2014 at 1430.
Statistical analyses:
NOEC = 71.7ppb
LC50 = 105.1ppb

Concentration	24 hour % Survival	48 hour % Survival
Control	100	100
42.6ppb	100	100
71.7ppb	85.0	85.0
111ppb	90.0	55.0 *
175ppb	0.00	0.00 *
266ppb	0.00	0.00 *
418ppb	0.00	0.00 *

*Significant difference compared to the control (p=0.05)

Ceriodaphnia dubia
Survival Data

Number of organisms per chamber: 5
Volume of test chamber: 30 ml

Age of organisms: <24 hours
Volume of test solution: 15 ml

Effluent Concentration		Number of Survivors 24 Hours	48 Hours	% Survival	CV %
Control	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
42.6ppb	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
71.7ppb	rep. A	5	5	85.0	22.5
	rep. B	5	5		
	rep. C	3	3		
	rep. D	4	4		
111ppb	rep. A	4	2	55.0	34.8
	rep. B	5	4		
	rep. C	5	3		
	rep. D	4	2		
175ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		
266ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		
418ppb	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		

CV = Coefficient of variance = standard deviation X 100/mean

Ceriodaphnia dubia

Transformation of Data — Transform: Arc Sin(Square Root(Y))

Group	Identification	Rep	Value	Transformed
1	Control	1	1.00000	1.34530
1	Control	2	1.00000	1.34530
1	Control	3	1.00000	1.34530
1	Control	4	1.00000	1.34530
2	42.6ppb	1	1.00000	1.34530
2	42.6ppb	2	1.00000	1.34530
2	42.6ppb	3	1.00000	1.34530
2	42.6ppb	4	1.00000	1.34530
3	71.7ppb	1	1.00000	1.34530
3	71.7ppb	2	1.00000	1.34530
3	71.7ppb	3	0.60000	0.88608
3	71.7ppb	4	0.80000	1.10710
4	111ppb	1	0.40000	0.68472
4	111ppb	2	0.80000	1.10710
4	111ppb	3	0.60000	0.88608
4	111ppb	4	0.40000	0.68472
5	175ppb	1	0.00000	0.22551
5	175ppb	2	0.00000	0.22551
5	175ppb	3	0.00000	0.22551
5	175ppb	4	0.00000	0.22551
6	266ppb	1	0.00000	0.22551
6	266ppb	2	0.00000	0.22551
6	266ppb	3	0.00000	0.22551
6	266ppb	4	0.00000	0.22551
7	418ppb	1	0.00000	0.22551
7	418ppb	2	0.00000	0.22551
7	418ppb	3	0.00000	0.22551
7	418ppb	4	0.00000	0.22551

Ceriodaphnia dubia

Shapiro - Wilk's Test for Normality	Transform: Arc Sin(Square Root(Y))
D = 0.2677	
W = 0.7358	
Critical W = 0.896	(alpha = 0.01, N = 28)
Critical W = 0.924	(alpha = 0.05, N = 28)
Data FAIL normality test (alpha = 0.01).	

Steel's Many-One Rank Test — Transform: Arc Sin(Square Root(Y))

Ho:Control<Treatment

Group	Identification	Rank Sum	Critical Value	DF	Sig 0.05
1	Control				
2	42.6ppb	18.00	10.00	4.00	
3	71.7ppb	14.00	10.00	4.00	
4	111ppb	10.00	10.00	4.00	*
5	175ppb	10.00	10.00	4.00	*
6	266ppb	10.00	10.00	4.00	*
7	418ppb	10.00	10.00	4.00	*

Critical values are 1 tailed (k=6)

Ceriodaphnia dubia

Probit Analysis for Calculating LC/EC Values

Concentration	Number Exposed	Number Responding	Observed Proportion Responding	Proportion Responding Adjusted for Controls	Predicted Proportion Responding
42.6	20	0	0	0	0.001
71.7	20	3	0.15	0.15	0.0952
111	20	9	0.45	0.45	0.5735
175	20	20	1	1	0.9593
266	20	20	1	1	0.9992
418	20	20	1	1	1

Chi - Square for Heterogeneity (calculated) = 2.828
Chi - Square for Heterogeneity (tabular value at 0.05 level) = 9.488

Mu = 2.022
Sigma = 0.127

Parameter	Estimate	Std. Error	Lower 95% Conf.	Upper 95% Conf.
Intercept	-10.92	3.034	-16.87	-4.972
Slope	7.874	1.496	4.942	10.81

Theoretical Spontaneous Response Rate = 0

Estimated LC/EC Values and Confidence Limits

LC/EC Point	Exposure Conc.	Lower 95% Conf.	Upper 95% Conf.
1	53.25	34.57	65.82
5	64.99	47.04	76.82
10	72.28	55.27	83.67
15	77.65	61.5	88.83
50	105.1	92.52	119.3
85	142.4	124.6	179.1
90	153	132.3	199.3
95	170.1	144.1	234.1
99	207.6	168.3	318.5

Chemical Data for
Ceriodaphnia dubia

Day 1		Control	42.6ppb	71.7ppb	111ppb	175ppb	266ppb	418ppb
DO, mg/l	Initial	8.1	8.3	8.2	8.2	8.3	8.2	8.1
DO, mg/l	Final	7.9	8.0	8.0	8.1	8.1	8.1	8.2
pH, su	Initial	7.8	7.8	7.8	7.8	7.8	7.8	7.8
pH, su	Final	7.7	7.7	7.7	7.7	7.7	7.7	7.7
Alkalinity, mg/l		64	NA	NA	NA	NA	NA	NA
Hardness, mg/l		94	NA	NA	NA	NA	NA	NA
Conductivity, umho/cm		290	280	280	280	280	280	280
Residual Chlorine, mg/l		<0.05	NA	NA	NA	NA	NA	NA

Day 2		Control	42.6ppb	71.7ppb	111ppb	175ppb	266ppb	418ppb
DO, mg/l	Final	8.7	8.8	8.7	8.6	8.6	8.5	8.6
pH, su	Final	7.7	7.7	7.7	7.7	7.7	7.7	7.7

Title: Van Buren third Zn definitive Site water total
File: VB3SITET.IN Transform: LOG 10 DOSE

Probit Analysis - not Using Smoothed Proportions

DOSE	NUMBER SUBJECTS	NUMBER OBSERVED	OBSERVED PROPORTION	PREDICTED PROPORTION
11.90	20	20	1.0000	0.9962
17.20	20	16	0.8000	0.8131
25.80	20	3	0.1500	0.1429
41.90	20	0	0.0000	0.0003

Est. Mu = 1.3156 Est. Sigma = 0.0900
sd = 0.0208 sd = 0.0190

Chi-Square lack of fit = 0.1142 Likelihood lack of fit = 0.1967
Table Chi-square = 9.2103 (alpha = 0.01, df = 2)
Table Chi-square = 5.9915 (alpha = 0.05, df = 2)

Title: Van Buren third Zn definitive Site water total
File: VB3SITET.IN Transform: LOG 10 DOSE

Probit EC Estimates

WITHOUT CONTROL DATA

POINT	EST. END POINT	95% CONFIDENCE LIMITS	
EC 1	12.7711	10.2825	15.8620
EC 5	14.7081	12.4586	17.3638
EC10	15.8581	13.7671	18.2667
EC20	17.3716	15.4699	19.5071
EC25	17.9838	16.1400	20.0382
EC30	18.5519	16.7461	20.5524
EC40	19.6237	17.8348	21.5919
EC50	20.6814	18.8243	22.7216
EC60	21.7961	19.7706	24.0291
EC70	23.0553	20.7335	25.6371
EC75	23.7836	21.2485	26.6211
EC80	24.6217	21.8109	27.7947
EC90	26.9717	23.2616	31.2735
EC95	29.0805	24.4558	34.5797
EC99	33.4912	26.7546	41.9240

Title: Van Buren third Zn definitive Site water total
File: VB3SITET.IN Transform: LOG 10 DOSE

Spearman - Karber Estimate

Estimated EC50: 20.8434 95% Confidence Interval: (18.9121, 22.9719)
[p1 = p2 true; Unconditional Variance] : (18.8746, 23.0175)
[p1 = p2 true; Conditional Variance] : (18.9121, 22.9719)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	Control	1.0000	1.0000	0.7163
2	11.9	1.0000	1.0000	1.0755
3	17.2	0.8000	0.8000	1.2355
4	25.8	0.1500	0.1500	1.4116
5	41.9	0.0000	0.0000	1.6222

Title: Van Buren third Zn definitive Site water total

File: VB3SITET.IN   Transform: LOG 10 DOSE

Trimmed Spearman - Karber	Estimate	95% C.I.	UNCONDITIONAL 95% C.I.
10.00%	20.6664	(18.71, 22.83)	(18.67, 22.88)
20.00%	20.7396	(19.26, 22.34)	(19.23, 22.37)
HIGH CALC 20.00%	20.7396	(19.26, 22.34)	(19.23, 22.37)
LOW CALC 0.00%	20.8434	(18.91, 22.97)	(18.87, 23.02)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	Control	1.0000	1.0000	0.7163
2	11.9	1.0000	1.0000	1.0755
3	17.2	0.8000	0.8000	1.2355
4	25.8	0.1500	0.1500	1.4116
5	41.9	0.0000	0.0000	1.6222

Title: Van Buren third Zn definitive dissolved Site water
File: VB3SITED.IN Transform: LOG 10 DOSE

Probit Analysis - not Using Smoothed Proportions

DOSE	NUMBER SUBJECTS	NUMBER OBSERVED	OBSERVED PROPORTION	PREDICTED PROPORTION
6.90	20	20	1.0000	0.9934
10.90	20	16	0.8000	0.8222
19.80	20	3	0.1500	0.1347
32.70	20	0	0.0000	0.0025

Est. Mu = 1.1555 Est. Sigma = 0.1278
sd = 0.0293 sd = 0.0245

Chi-Square lack of fit = 0.2906 Likelihood lack of fit = 0.4694
Table Chi-square = 9.2103 (alpha = 0.01, df = 2)
Table Chi-square = 5.9915 (alpha = 0.05, df = 2)

Title: Van Buren third Zn definitive dissolved Site water
File: VB3SITED.IN Transform: LOG 10 DOSE

Probit EC Estimates

WITHOUT CONTROL DATA

POINT	EST. END POINT	95% CONFIDENCE LIMITS	
EC 1	7.2134	5.4225	9.5959
EC 5	8.8155	7.0648	10.9999
EC10	9.8102	8.1072	11.8710
EC20	11.1663	9.5225	13.0938
EC25	11.7293	10.0982	13.6237
EC30	12.2590	10.6287	14.1393
EC40	13.2769	11.6080	15.1858
EC50	14.3047	12.5320	16.3282
EC60	15.4121	13.4504	17.6598
EC70	16.6919	14.4216	19.3195
EC75	17.4457	14.9556	20.3504
EC80	18.3253	15.5495	21.5965
EC90	20.8583	17.1280	25.4011
EC95	23.2121	18.4719	29.1686
EC99	28.3673	21.1597	38.0300

Title: Van Buren third Zn definitive dissolved Site water
File: VB3SITED.IN Transform: LOG 10 DOSE

Spearman - Karber Estimate

Estimated EC50: 14.3565 95% Confidence Interval: (12.6543, 16.2876)
[p1 = p2 true; Unconditional Variance] : (12.6218, 16.3296)
[p1 = p2 true; Conditional Variance] : (12.6543, 16.2876)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	Control	1.0000	1.0000	0.4963
2	6.9	1.0000	1.0000	0.8388
3	10.9	0.8000	0.8000	1.0374
4	19.8	0.1500	0.1500	1.2967
5	32.7	0.0000	0.0000	1.5145

Title: Van Buren third Zn definitive dissolved Site water
File: VB3SITED.IN Transform: LOG 10 DOSE

Trimmed Spearman - Karber	Estimate	95% C.I.	UNCONDITIONAL 95% C.I.
10.00%	14.2892	(12.50, 16.34)	(12.46, 16.38)
20.00%	14.3574	(12.87, 16.01)	(12.84, 16.05)
HIGH CALC 20.00%	14.3574	(12.87, 16.01)	(12.84, 16.05)
LOW CALC 0.00%	14.3565	(12.65, 16.29)	(12.62, 16.33)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	Control	1.0000	1.0000	0.4963
2	6.9	1.0000	1.0000	0.8388
3	10.9	0.8000	0.8000	1.0374
4	19.8	0.1500	0.1500	1.2967
5	32.7	0.0000	0.0000	1.5145

Title: Van Buren third Zn definitive lab water total

File: VB3LABT .IN Transform: LOG 10 DOSE

Probit Analysis - not Using Smoothed Proportions

DOSE	NUMBER SUBJECTS	NUMBER OBSERVED	OBSERVED PROPORTION	PREDICTED PROPORTION
47.20	20	20	1.0000	0.9982
75.20	20	17	0.8500	0.9063
117.00	20	11	0.5500	0.4207
180.00	20	0	0.0000	0.0465

Est. Mu = 2.0429 Est. Sigma = 0.1264
sd = 0.0259 sd = 0.0248

Chi-Square lack of fit = 3.1294 Likelihood lack of fit = 3.9669
Table Chi-square = 9.2103 (alpha = 0.01, df = 2)
Table Chi-square = 5.9915 (alpha = 0.05, df = 2)

Title: Van Buren third Zn definitive lab water total

File: VB3LABT .IN Transform: LOG 10 DOSE

Probit EC Estimates

	WITHOUT CONTROL DATA		
POINT	EST. END POINT	95% CONFIDENCE LIMITS	
EC 1	56.0825	42.4942	74.0160
EC 5	68.3873	55.3942	84.4280
EC10	76.0153	63.6031	90.8497
EC20	86.3998	74.7637	99.8469
EC25	90.7068	79.2976	103.7575
EC30	94.7573	83.4646	107.5779
EC40	102.5361	91.1023	115.4049
EC50	110.3831	98.2087	124.0666
EC60	118.8306	105.1579	134.2810
EC70	128.5856	112.4012	147.1003
EC75	134.3275	116.3541	155.0774
EC80	141.0238	120.7368	164.7194
EC90	160.2891	132.3611	194.1099
EC95	178.1678	142.2618	223.1363
EC99	217.2588	162.0868	291.2105

Title: Van Buren third Zn definitive lab water total
File: VB3LABT .IN Transform: LOG 10 DOSE

Spearman - Karber Estimate

Estimated EC50: 111.3970 95% Confidence Interval: (98.9251, 125.4414)
[p1 = p2 true; Unconditional Variance] : (98.6854, 125.7460)
[p1 = p2 true; Conditional Variance] : (98.9251, 125.4414)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	Control	1.0000	1.0000	1.3330
2	47.2	1.0000	1.0000	1.6739
3	75.2	0.8500	0.8500	1.8762
4	117	0.5500	0.5500	2.0682
5	180	0.0000	0.0000	2.2553

Title: Van Buren third Zn definitive lab water total

File: VB3LABT .IN Transform: LOG 10 DOSE

Trimmed Spearman - Karber	Estimate	95% C.I.	UNCONDITIONAL 95% C.I.
10.00%	115.1166	(100.52,131.83)	(100.24,132.20)
20.00%	117.3769	(100.89,136.56)	(100.58,136.99)
HIGH CALC 15.00%	116.3925	(101.19,133.88)	(100.90,134.26)
LOW CALC 0.00%	111.3970	(98.93,125.44)	(98.69,125.75)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	Control	1.0000	1.0000	1.3330
2	47.2	1.0000	1.0000	1.6739
3	75.2	0.8500	0.8500	1.8762
4	117	0.5500	0.5500	2.0682
5	180	0.0000	0.0000	2.2553

Title: Van Buren third Zn definitive lab water dissolved
File: VB3LABD .IN   Transform: LOG 10 DOSE

Probit Analysis - not Using Smoothed Proportions

DOSE	NUMBER SUBJECTS	NUMBER OBSERVED	OBSERVED PROPORTION	PREDICTED PROPORTION
46.90	20	20	1.0000	0.9989
76.70	20	17	0.8500	0.9039
116.50	20	11	0.5500	0.4280
180.00	20	0	0.0000	0.0420

Est. Mu =   2.0441   Est. Sigma =   0.1222
sd =   0.0252   sd =   0.0245

Chi-Square lack of fit = 2.7844   Likelihood lack of fit = 3.5431
Table Chi-square =   9.2103   (alpha = 0.01, df = 2)
Table Chi-square =   5.9915   (alpha = 0.05, df = 2)

Title: Van Buren third Zn definitive lab water dissolved

File: VB3LABD .IN Transform: LOG 10 DOSE

Probit EC Estimates

WITHOUT CONTROL DATA

POINT	EST. END POINT	95% CONFIDENCE LIMITS	
EC 1	57.5244	43.8193	75.5159
EC 5	69.6844	56.7032	85.6374
EC10	77.1851	64.8552	91.8592
EC20	87.3567	75.8846	100.5630
EC25	91.5631	80.3465	104.3457
EC30	95.5130	84.4365	108.0426
EC40	103.0830	91.9018	115.6247
EC50	110.7001	98.8059	124.0262
EC60	118.8800	105.5157	133.9369
EC70	128.3020	112.4701	146.3625
EC75	133.8367	116.2510	154.0827
EC80	140.2814	120.4333	163.4005
EC90	158.7678	131.4854	191.7113
EC95	175.8574	140.8599	219.5501
EC99	213.0315	159.5416	284.4553

Title: Van Buren third Zn definitive lab water dissolved
File: VB3LABD .IN Transform: LOG 10 DOSE

Spearman - Karber Estimate

Estimated EC50: 111.6363 95% Confidence Interval: (99.2982, 125.5075)
[p1 = p2 true; Unconditional Variance] : (99.0609, 125.8081)
[p1 = p2 true; Conditional Variance] : (99.2982, 125.5075)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	Control	1.0000	1.0000	1.3350
2	46.9	1.0000	1.0000	1.6712
3	76.7	0.8500	0.8500	1.8848
4	116.5	0.5500	0.5500	2.0663
5	180	0.0000	0.0000	2.2553

Title: Van Buren third Zn definitive lab water dissolved

File: VB3LABD .IN   Transform: LOG 10 DOSE

Trimmed Spearman - Karber	Estimate	95% C.I.	UNCONDITIONAL 95% C.I.
10.00%	115.3977	(101.05,131.78)	(100.77,132.14)
20.00%	117.4573	(101.36,136.11)	(101.06,136.52)
HIGH CALC 15.00%	116.5972	(101.76,133.59)	(101.48,133.97)
LOW CALC 0.00%	111.6363	(99.30,125.51)	(99.06,125.81)

GROUP	IDENTIFICATION	OBS PROP	SMOOTH PROP	DOSES
1	Control	1.0000	1.0000	1.3350
2	46.9	1.0000	1.0000	1.6712
3	76.7	0.8500	0.8500	1.8848
4	116.5	0.5500	0.5500	2.0663
5	180	0.0000	0.0000	2.2553

APPENDIX H

Laboratory Reports for Additional WER Testing

October 16, 2014

Test Results of
Acute 48 hour Non-Renewal
Biomonitoring Testing
for

183083-1: Effluent Total Cu + Zn
183083-2: Hardness Adjusted Lab Water Total Cu + Zn

Prepared for:

Mr. Pat Downey
FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Prepared by:

AMERICAN INTERPLEX CORPORATION
8600 Kanis Road
Little Rock, AR 72204-2322

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Re: Acute 48 hour Non-Renewal Biomonitoring utilizing *Ceriodaphnia dubia*
Effluent Total Cu + Zn

Dear Mr. Pat Downey:

Please find attached the data for the water effects ratio study. The spiking solution utilized for the study was prepared from zinc sulfate and copper sulfate. The tests were conducted at 25 +/- 1 C. The effluent was undiluted. The LC50 data presented here is derived from the summation of the measured zinc and copper concentrations. The LC50 data is summarized below for your review.

Ceriodaphnia dubia

Analyte	**Effluent**	**Synthetic Water**
Combined Cu+Zn (total)	200 ug/L	35.4 ug/L

If I can be of further assistance, please feel free to contact me.

AMERICAN INTERPLEX CORPORATION

John Overbey
Laboratory Director

PDF cc: FTN Associates, Ltd.
ATTN: Mr. Pat Downey
pjd@ftn-assoc.com

Dilution Water Samples: North Plant Effluent

Analysis	Result
Dissolved oxygen (mg/l)	8.4
pH (standard units)	7.3
Alkalinity (mg/l as CaCO3)	55
Hardness (mg/l as CaCO3)	67
Conductivity (umhos/cm)	340
Residual Chlorine (mg/l)	<0.05

Results Summary: Effluent Total Cu + Zn

Ceriodaphnia dubia

The *Ceriodaphnia dubia* test was conducted from October 1, 2014 at 1440 to October 3, 2014 at 1455.

Statistical analyses:

NOEC = 155ug/L
LC50 = 202.9ug/L

Concentration	24 hour % Survival	48 hour % Survival
Control	100	100
155ug/L	100	100
193ug/L	70.0	60.0 *
264ug/L	0.00	0.00 *
377ug/L	0.00	0.00 *
550ug/L	0.00	0.00 *

*Significant difference compared to the control (p=0.05)

Ceriodaphnia dubia
Survival Data

Number of organisms per chamber: 5
Volume of test chamber: 30 ml
Age of organisms: <24 hours
Volume of test solution: 15 ml

Effluent Concentration		Number of Survivors 24 Hours	48 Hours	% Survival	CV %
Control	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
59.6ug/L	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
99.4ug/L	rep. A	3	3	60.0	27.2
	rep. B	2	2		
	rep. C	4	3		
	rep. D	5	4		
166ug/L	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		
276ug/L	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		
460ug/L	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		

CV = Coefficient of variance = standard deviation X 100/mean

Ceriodaphnia dubia

		Transformation of Data		Transform: Arc Sin(Square Root(Y))
Group	Identification	Rep	Value	Transformed
1	Control	1	1.00000	1.34530
1	Control	2	1.00000	1.34530
1	Control	3	1.00000	1.34530
1	Control	4	1.00000	1.34530
2	155ug/L	1	1.00000	1.34530
2	155ug/L	2	1.00000	1.34530
2	155ug/L	3	1.00000	1.34530
2	155ug/L	4	1.00000	1.34530
3	193ug/L	1	0.60000	0.88608
3	193ug/L	2	0.40000	0.68472
3	193ug/L	3	0.60000	0.88608
3	193ug/L	4	0.80000	1.10710
4	264ug/L	1	0.00000	0.22551
4	264ug/L	2	0.00000	0.22551
4	264ug/L	3	0.00000	0.22551
4	264ug/L	4	0.00000	0.22551
5	377ug/L	1	0.00000	0.22551
5	377ug/L	2	0.00000	0.22551
5	377ug/L	3	0.00000	0.22551
5	377ug/L	4	0.00000	0.22551
6	550ug/L	1	0.00000	0.22551
6	550ug/L	2	0.00000	0.22551
6	550ug/L	3	0.00000	0.22551
6	550ug/L	4	0.00000	0.22551

Ceriodaphnia dubia

Shapiro - Wilk's Test for Normality	Transform: Arc Sin(Square Root(Y))
D = 0.0893	
W = 0.4152	
Critical W = 0.884	(alpha = 0.01, N = 24)
Critical W = 0.916	(alpha = 0.05, N = 24)

Data FAIL normality test (alpha = 0.01).

Steel's Many-One Rank Test — Transform: Arc Sin(Square Root(Y))

Ho:Control<Treatment

Group	Identification	Rank Sum	Critical Value	DF	Sig 0.05
1	Control				
2	155ug/L	18.00	10.00	4.00	
3	193ug/L	10.00	10.00	4.00	*
4	264ug/L	10.00	10.00	4.00	*
5	377ug/L	10.00	10.00	4.00	*
6	550ug/L	10.00	10.00	4.00	*

Critical values are 1 tailed (k=5)

Ceriodaphnia dubia

Spearman-Karber Method for Calculating LC50 Values

Concentration	Number Exposed	Number Responding	Proportion Responding	Smoothed Proportion	Smoothed Adjusted Proportion
Control	20	0	0	0	0
155	20	0	0	0	0
193	20	8	0.4	0.4	0.4
264	20	20	1	1	1
377	20	20	1	1	1
550	20	20	1	1	1

LC50 = 202.9
Upper Confidence Limit = 215.4
Lower Confidence Limit = 191.1

Variance = 0.0001689

Chemical Data for
Ceriodaphnia dubia

Day 1		Control	155ug/L	193ug/L	264ug/L	377ug/L	550ug/L
DO, mg/l	Initial	8.4	8.5	8.5	8.3	8.3	8.3
DO, mg/l	Final	8.4	8.3	8.3	8.4	8.4	8.5
pH, su	Initial	7.3	7.4	7.5	7.4	7.4	7.3
pH, su	Final	7.4	7.4	7.5	7.5	7.4	7.4
Alkalinity, mg/l		55	NA	NA	NA	NA	NA
Hardness, mg/l		67	NA	NA	NA	NA	NA
Conductivity, umho/cm		340	330	330	330	330	330
Residual Chlorine, mg/l		<0.05	NA	NA	NA	NA	NA

Day 2		Control	155ug/L	193ug/L	264ug/L	377ug/L	550ug/L
DO, mg/l	Final	8.1	8.2	9.4	9.3	9.2	9.1
pH, su	Final	7.6	7.6	7.7	7.7	7.7	7.7

AMERICAN INTERPLEX CORPORATION LABORATORIES

COPY

CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

Client: VAN BUREN MUNICIPAL UTILITIES

Project Reference: NORTH PLANT

Project Manager: Clyde Hill

Sampled By: [signature]

PO No.:

AIC CONTROL NO: 183083

AIC PROPOSAL NO:

Carrier: Fed-X

Received Temperature C: 0.8

AIC No.	Sample Identification	Date/Time Collected	GRAB	COMP	MATRIX: WATER	MATRIX: SOIL	MATRIX	NO OF BOTTLES	BIOMONITORING UDER												Remarks
1	NP1	9/28-29/14 7:06-9:30Am		X	X			4													pH 6.84
																					Field pH calibration
		Container Type						P													on 9/29/14 @ 7:00A
		Preservative						NO													Buffer: 4-7

G = Glass P = Plastic V = VOA vials H = HCl to pH2 T = Sodium Thiosulfate

NO = none S = Sulfuric acid pH2 N = Nitric acid pH2 B = NaOH to pH12 Z = Zinc acetate A=$(NH_4)_2SO_4$, NH_4OH

Turnaround Time Requested: (Please circle)
NORMAL or EXPEDITED IN ____ DAYS
Expedited results requested by: ____________
Who should AIC contact with questions: Clyde Hill
Phone:________ Fax: 479-719-6508
Report Attention to: VBFred@aol.com
Report Address to:

Email Address:

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	9/29/14 10:51	FedEX - @ 7713 0872 5828	9/29/14 10:51
Relinquished By:	Date/Time	Received in Lab By:	Date/Time
		[signature]	9-30-14 1215

Comments: 7713 0872 5828

9/2014

FORM 0060

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

Re: Acute 48 hour Non-Renewal Biomonitoring utilizing *Ceriodaphnia dubia*
Hardness Adjusted Lab Water Total Cu + Zn

Dilution Water Samples: Hardness Adjusted Lab Water

Analysis	Result
Dissolved oxygen (mg/l)	8.3
pH (standard units)	7.4
Alkalinity (mg/l as CaCO3)	42
Hardness (mg/l as CaCO3)	67
Conductivity (umhos/cm)	210
Residual Chlorine (mg/l)	<0.05

Results Summary: Hardness Adjusted Lab Water Total Cu + Zn
Ceriodaphnia dubia

The *Ceriodaphnia dubia* test was conducted from October 1, 2014 at 1455 to October 3, 2014 at 1450.
Statistical analyses:
NOEC = <35.4ug/L
LC50 = 35.4ug/L

Concentration	24 hour % Survival	48 hour % Survival
Control	100	100
35.4ug/L	50.0	50.0 *
59.2ug/L	0.00	0.00 *
98.2ug/L	0.00	0.00 *
167ug/L	0.00	0.00 *
290ug/L	0.00	0.00 *
458ug/L	0.00	0.00 *

*Significant difference compared to the control (p=0.05)

Ceriodaphnia dubia
Survival Data

Number of organisms per chamber: 5
Volume of test chamber: 30 ml
Age of organisms: <24 hours
Volume of test solution: 15 ml

Effluent Concentration		Number of Survivors 24 Hours	48 Hours	% Survival	CV %
Control	rep. A	5	5	100	0.00
	rep. B	5	5		
	rep. C	5	5		
	rep. D	5	5		
35.8ug/L	rep. A	2	2	50.0	51.6
	rep. B	3	3		
	rep. C	1	1		
	rep. D	4	4		
59.6ug/L	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		
99.4ug/L	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		
166ug/L	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		
276ug/L	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		
460ug/L	rep. A	0	0	0.00	0.00
	rep. B	0	0		
	rep. C	0	0		
	rep. D	0	0		

CV = Coefficient of variance = standard deviation X 100/mean

Ceriodaphnia dubia

Transformation of Data — Transform: Arc Sin(Square Root(Y))

Group	Identification	Rep	Value	Transformed
1	Control	1	1.00000	1.34530
1	Control	2	1.00000	1.34530
1	Control	3	1.00000	1.34530
1	Control	4	1.00000	1.34530
2	35.4ug/L	1	0.40000	0.68472
2	35.4ug/L	2	0.60000	0.88608
2	35.4ug/L	3	0.20000	0.46365
2	35.4ug/L	4	0.80000	1.10710
3	59.2ug/L	1	0.00000	0.22551
3	59.2ug/L	2	0.00000	0.22551
3	59.2ug/L	3	0.00000	0.22551
3	59.2ug/L	4	0.00000	0.22551
4	98.2ug/L	1	0.00000	0.22551
4	98.2ug/L	2	0.00000	0.22551
4	98.2ug/L	3	0.00000	0.22551
4	98.2ug/L	4	0.00000	0.22551
5	167ug/L	1	0.00000	0.22551
5	167ug/L	2	0.00000	0.22551
5	167ug/L	3	0.00000	0.22551
5	167ug/L	4	0.00000	0.22551
6	290ug/L	1	0.00000	0.22551
6	290ug/L	2	0.00000	0.22551
6	290ug/L	3	0.00000	0.22551
6	290ug/L	4	0.00000	0.22551
7	458ug/L	1	0.00000	0.22551
7	458ug/L	2	0.00000	0.22551
7	458ug/L	3	0.00000	0.22551
7	458ug/L	4	0.00000	0.22551

Ceriodaphnia dubia

Shapiro - Wilk's Test for Normality	Transform: Arc Sin(Square Root(Y))
D = 0.2273	
W = 0.5048	
Critical W = 0.896	(alpha = 0.01, N = 28)
Critical W = 0.924	(alpha = 0.05, N = 28)

Data FAIL normality test (alpha = 0.01).

Steel's Many-One Rank Test — Transform: Arc Sin(Square Root(Y))

Ho:Control<Treatment

Group	Identification	Rank Sum	Critical Value	DF	Sig 0.05
1	Control				
2	35.4ug/L	10.00	10.00	4.00	*
3	59.2ug/L	10.00	10.00	4.00	*
4	98.2ug/L	10.00	10.00	4.00	*
5	167ug/L	10.00	10.00	4.00	*
6	290ug/L	10.00	10.00	4.00	*
7	458ug/L	10.00	10.00	4.00	*

Critical values are 1 tailed (k=6)

Ceriodaphnia dubia

Trimmed Spearman-Karber Method for Calculating LC50 Values

Concentration	Exposed	Responding
Control	20	0
35.4	20	10
59.2	20	20
98.2	20	20
167	20	20
290	20	20
458	20	20

Spearman-Karber Trim (Calculated) 50 %

LC50 = 35.4
Upper Confidence Limit = 35.4
Lower Confidence Limit = 35.4

Chemical Data for
Ceriodaphnia dubia

Day 1		Control	35.4ug/L	59.2ug/L	98.2ug/L	167ug/L	290ug/L	458ug/L
DO, mg/l	Initial	8.3	8.3	8.4	8.3	8.3	8.3	8.4
DO, mg/l	Final	8.4	8.5	8.5	8.5	8.4	8.5	8.4
pH, su	Initial	7.4	7.5	7.5	7.5	7.4	7.5	7.4
pH, su	Final	7.5	7.5	7.5	7.5	7.5	7.5	7.4
Alkalinity, mg/l		42	NA	NA	NA	NA	NA	NA
Hardness, mg/l		67	NA	NA	NA	NA	NA	NA
Conductivity, umho/cm		210	210	210	210	210	210	210
Residual Chlorine, mg/l		<0.05	NA	NA	NA	NA	NA	NA

Day 2		Control	35.4ug/L	59.2ug/L	98.2ug/L	167ug/L	290ug/L	458ug/L
DO, mg/l	Final	9.0	9.0	8.9	8.9	11	9.0	9.0
pH, su	Final	7.6	7.6	7.6	7.6	7.6	7.5	7.5

AMERICAN INTERPLEX CORPORATION LABORATORIES

FTN Associates, Ltd.
ATTN: Mr. Pat Downey
3 Innwood Circle, Suite 220
Little Rock, AR 72211

This report contains the analytical results and supporting information for samples submitted on November 13, 2014. Attached please find a copy of the Chain of Custody and/or other documents received. Note that any remaining sample will be discarded two weeks from the original report date unless other arrangements are made.

This report is intended for the sole use of the client listed above. Assessment of the data requires access to the entire document.

This report has been reviewed by the Laboratory Director or a qualified designee.

John Overbey
Laboratory Director

This document has been distributed to the following:

PDF cc: FTN Associates, Ltd.
ATTN: Mr. Pat Downey
pjd@ftn-assoc.com

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

SAMPLE INFORMATION

Project Description:
One (1) water sample(s) received on November 13, 2014
Van Buren WER Study
North Plant

Receipt Details:
A Chain of Custody was provided. The samples were delivered in one (1) ice chest.
Ice chest #1 was delivered with shipping documentation.

Each sample container was checked for proper labeling, including date and time sampled. Sample containers were reviewed for proper type, adequate volume, integrity, temperature, preservation, and holding times. Any exceptions are noted below:

Sample Identification:

Laboratory ID	Client Sample ID	Sampled Date/Time	Notes
184644-1	NPE1 11/11-12/14 8:00-8:00am	12-Nov-2014 0800	1
184644-2	Hardness adjusted Mod Water		1
184644-3	Effluent-CD-72.7-Initial		1,2
184644-4	Effluent-CD-109-Initial		1,2
184644-5	Effluent-CD-168-Initial		1,2
184644-6	Effluent-CD-268-Initial		1,2
184644-7	Effluent-CD-403-Initial		1,2
184644-8	Synthetic Adjusted MOD-CD-460-Initial		1,2
184644-9	Synthetic Adjusted MOD-CD-276-Initial		1,2
184644-10	Synthetic Adjusted MOD-CD-166-Initial		1,2
184644-11	Synthetic Adjusted MOD-CD-99.4-Initial		1,2
184644-12	Synthetic Adjusted MOD-CD-59.6-Initial		1,2
184644-13	Synthetic Adjusted MOD-CD-35.8-Initial		1,2
184644-14	Effluent-CD-72.7-Final		
184644-15	Effluent-CD-109-Final		
184644-16	Effluent-CD-168-Final		
184644-17	Effluent-CD-268-Final		
184644-18	Effluent-CD-403-Final		
184644-19	Synthetic Adjusted MOD-CD-460-Final		
184644-20	Synthetic Adjusted MOD-CD-276-Final		
184644-21	Synthetic Adjusted MOD-CD-166-Final		
184644-22	Synthetic Adjusted MOD-CD-99.4-Final		
184644-23	Synthetic Adjusted MOD-CD-59.6-Final		
184644-24	Synthetic Adjusted MOD-CD-35.8-Final		

Notes:
1. Sample was received unpreserved
2. Sample label was incomplete in regard to date/time of sampling

Qualifiers:
H Analytical holding time exceeded regulatory requirements

Case Narrative:
Table II of 40 CFR Part 136.3 indicates analysis of pH, Total Residual Chlorine, and Dissolved Oxygen are to be performed on site or immediately after collection. American Interplex Corporation analyzes these parameters as soon as possible after laboratory receipt.

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Little Rock, AR 72211

SAMPLE INFORMATION

References:

"Methods for Chemical Analysis of Water and Wastes", EPA/600/4-79-020 (Mar 1983) with updates and supplements EPA/600/5-91-010 (Jun 1991), EPA/600/R-92-129 (Aug 1992) and EPA/600/R-93-100 (Aug 1993).
"Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846)", Third Edition.
"Standard Methods for the Examination of Water and Wastewaters", (SM).
"American Society for Testing and Materials" (ASTM).
"Association of Analytical Chemists" (AOAC).

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Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 184644-1
Sample Identification: NPE1 11/11-12/14 8:00-8:00am

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3 SM 2320 B 1997		**26** Analyzed: 14-Nov-2014 1100 by 93	1	**mg/l** Batch: W49951	
pH SM 4500-H+ B 2000		**7.0** Analyzed: 13-Nov-2014 1707 by 93		**Units** Batch: W49946	H
Ammonia as N SM 4500-NH3 G 1997	Prep: 17-Nov-2014 1453 by 308	**0.25** Analyzed: 17-Nov-2014 1557 by 308	0.1	**mg/l** Batch: W49976	
Carbonaceous BOD 5-day SM 5210 B 2001	Prep: 13-Nov-2014 1648 by 271	**< 2** Analyzed: 18-Nov-2014 0938 by 271	2	**mg/l** Batch: W49935	
Total Organic Carbon SM 5310 C 2000	Prep: 14-Nov-2014 1643 by 93	**5.1** Analyzed: 17-Nov-2014 1809 by 93	1	**mg/l** Batch: W49961	
Total Suspended Solids USGS 3765	Prep: 17-Nov-2014 0925 by 271	**< 4** Analyzed: 18-Nov-2014 1115 by 271	4	**mg/l** Batch: W49970	
Potassium EPA 200.7	Prep: 13-Nov-2014 1630 by 302	**8.7** Analyzed: 14-Nov-2014 1311 by 302	1	**mg/l** Batch: S37746	
Sodium EPA 200.7	Prep: 13-Nov-2014 1630 by 302	**33** Analyzed: 14-Nov-2014 1311 by 302	1	**mg/l** Batch: S37746	
Hardness as CaCO3 SM 2340 B 1997	Prep: 13-Nov-2014 1630 by 302	**68** Analyzed: 13-Nov-2014 1709 by 302	1	**mg/l** Batch: S37746	
Chloride EPA 300.0	Prep: 14-Nov-2014 1707 by 07	**31** Analyzed: 15-Nov-2014 0020 by 07	0.2	**mg/l** Batch: C17241	
Sulfate EPA 300.0	Prep: 14-Nov-2014 1707 by 07	**26** Analyzed: 15-Nov-2014 0020 by 07	0.2	**mg/l** Batch: C17241	
Dissolved Organic Carbon SM 5310 C 2000	Prep: 14-Nov-2014 1644 by 93	**3.7** Analyzed: 17-Nov-2014 1845 by 308	1	**mg/l** Batch: W49961	
Dissolved Copper EPA 200.7	Prep: 13-Nov-2014 1630 by 302	**4.53** Analyzed: 13-Nov-2014 1701 by 302	1	**ug/l** Batch: S37746	
Dissolved Zinc EPA 200.7	Prep: 13-Nov-2014 1630 by 302	**51.7** Analyzed: 13-Nov-2014 1701 by 302	2	**ug/l** Batch: S37746	
Total Recoverable Copper EPA 200.7	Prep: 13-Nov-2014 1630 by 302	**5.11** Analyzed: 13-Nov-2014 1709 by 302	1	**ug/l** Batch: S37746	
Total Recoverable Zinc EPA 200.7	Prep: 13-Nov-2014 1630 by 302	**53.0** Analyzed: 13-Nov-2014 1709 by 302	2	**ug/l** Batch: S37746	

AIC No. 184644-2
Sample Identification: Hardness adjusted Mod Water

Analyte		Result	RL	Units	Qualifier
Alkalinity as CaCO3 SM 2320 B 1997		**46** Analyzed: 14-Nov-2014 1100 by 93	1	**mg/l** Batch: W49951	
Carbonaceous BOD 5-day SM 5210 B 2001	Prep: 14-Nov-2014 0818 by 271	**59** Analyzed: 19-Nov-2014 0927 by 271	50	**mg/l** Batch: W49948	

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ANALYTICAL RESULTS

AIC No. 184644-2 (Continued)
Sample Identification: Hardness adjusted Mod Water

Analyte		Result	RL	Units	Qualifier
Total Organic Carbon		**< 1**	1	**mg/l**	
SM 5310 C 2000	Prep: 14-Nov-2014 1643 by 93	Analyzed: 17-Nov-2014 1827 by 93		Batch: W49961	
Total Suspended Solids		**< 4**	4	**mg/l**	
USGS 3765	Prep: 17-Nov-2014 0925 by 271	Analyzed: 18-Nov-2014 1115 by 271		Batch: W49970	
Hardness as CaCO3		**75**	1	**mg/l**	
SM 2340 B 1997	Prep: 13-Nov-2014 1630 by 302	Analyzed: 14-Nov-2014 1315 by 302		Batch: S37746	
Dissolved Organic Carbon		**< 1**	1	**mg/l**	
SM 5310 C 2000	Prep: 14-Nov-2014 1644 by 93	Analyzed: 17-Nov-2014 1903 by 308		Batch: W49961	
Dissolved Copper		**< 1**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1535 by 302		Batch: S37748	
Dissolved Zinc		**< 2**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1535 by 302		Batch: S37748	
Total Recoverable Copper		**< 1**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1538 by 302		Batch: S37748	
Total Recoverable Zinc		**< 2**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1538 by 302		Batch: S37748	

AIC No. 184644-3
Sample Identification: Effluent-CD-72.7-Initial

Analyte		Result	RL	Units	Qualifier
Copper		**11.3**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1400 by 302		Batch: S37748	
Zinc		**64.6**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1400 by 302		Batch: S37748	
Dissolved Copper		**10.8**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1357 by 302		Batch: S37748	
Dissolved Zinc		**63.6**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1357 by 302		Batch: S37748	

AIC No. 184644-4
Sample Identification: Effluent-CD-109-Initial

Analyte		Result	RL	Units	Qualifier
Copper		**17.3**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1406 by 302		Batch: S37748	
Zinc		**98.2**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1406 by 302		Batch: S37748	
Dissolved Copper		**15.4**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1403 by 302		Batch: S37748	
Dissolved Zinc		**96.8**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1403 by 302		Batch: S37748	

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ANALYTICAL RESULTS

AIC No. 184644-5
Sample Identification: Effluent-CD-168-Initial

Analyte		Result	RL	Units	Qualifier
Copper		**26.4**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1412 by 302		Batch: S37748	
Zinc		**137**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1412 by 302		Batch: S37748	
Dissolved Copper		**24.2**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1409 by 302		Batch: S37748	
Dissolved Zinc		**139**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1409 by 302		Batch: S37748	

AIC No. 184644-6
Sample Identification: Effluent-CD-268-Initial

Analyte		Result	RL	Units	Qualifier
Copper		**42.1**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1418 by 302		Batch: S37748	
Zinc		**233**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1418 by 302		Batch: S37748	
Dissolved Copper		**37.0**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1415 by 302		Batch: S37748	
Dissolved Zinc		**222**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1415 by 302		Batch: S37748	

AIC No. 184644-7
Sample Identification: Effluent-CD-403-Initial

Analyte		Result	RL	Units	Qualifier
Copper		**59.9**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1424 by 302		Batch: S37748	
Zinc		**367**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1424 by 302		Batch: S37748	
Dissolved Copper		**52.7**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1421 by 302		Batch: S37748	
Dissolved Zinc		**350**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1421 by 302		Batch: S37748	

AIC No. 184644-8
Sample Identification: Synthetic Adjusted MOD-CD-460-Initial

Analyte		Result	RL	Units	Qualifier
Copper		**64.2**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1452 by 302		Batch: S37748	
Zinc		**396**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1452 by 302		Batch: S37748	

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ANALYTICAL RESULTS

AIC No. 184644-8 (Continued)
Sample Identification: Synthetic Adjusted MOD-CD-460-Initial

Analyte		Result	RL	Units	Qualifier
Dissolved Copper		**63.5**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1449 by 302		Batch: S37748	
Dissolved Zinc		**399**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1449 by 302		Batch: S37748	

AIC No. 184644-9
Sample Identification: Synthetic Adjusted MOD-CD-276-Initial

Analyte		Result	RL	Units	Qualifier
Copper		**40.0**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1457 by 302		Batch: S37748	
Zinc		**250**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1457 by 302		Batch: S37748	
Dissolved Copper		**38.3**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1454 by 302		Batch: S37748	
Dissolved Zinc		**235**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1454 by 302		Batch: S37748	

AIC No. 184644-10
Sample Identification: Synthetic Adjusted MOD-CD-166-Initial

Analyte		Result	RL	Units	Qualifier
Copper		**25.4**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1503 by 302		Batch: S37748	
Zinc		**156**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1503 by 302		Batch: S37748	
Dissolved Copper		**24.6**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1500 by 302		Batch: S37748	
Dissolved Zinc		**155**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1500 by 302		Batch: S37748	

AIC No. 184644-11
Sample Identification: Synthetic Adjusted MOD-CD-99.4-Initial

Analyte		Result	RL	Units	Qualifier
Copper		**15.7**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1509 by 302		Batch: S37748	
Zinc		**92.0**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1509 by 302		Batch: S37748	
Dissolved Copper		**15.0**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1506 by 302		Batch: S37748	
Dissolved Zinc		**91.8**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1506 by 302		Batch: S37748	

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ANALYTICAL RESULTS

AIC No. 184644-12
Sample Identification: Synthetic Adjusted MOD-CD-59.6-Initial

Analyte		Result	RL	Units	Qualifier
Copper		**10.8**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1525 by 302		Batch: S37748	
Zinc		**55.0**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1525 by 302		Batch: S37748	
Dissolved Copper		**10.8**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1521 by 302		Batch: S37748	
Dissolved Zinc		**56.0**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1521 by 302		Batch: S37748	

AIC No. 184644-13
Sample Identification: Synthetic Adjusted MOD-CD-35.8-Initial

Analyte		Result	RL	Units	Qualifier
Copper		**7.33**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1531 by 302		Batch: S37748	
Zinc		**34.5**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1531 by 302		Batch: S37748	
Dissolved Copper		**7.07**	1	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1528 by 302		Batch: S37748	
Dissolved Zinc		**34.7**	2	**ug/l**	
EPA 200.7	Prep: 14-Nov-2014 1300 by 302	Analyzed: 14-Nov-2014 1528 by 302		Batch: S37748	

AIC No. 184644-14
Sample Identification: Effluent-CD-72.7-Final

Analyte		Result	RL	Units	Qualifier
Copper		**11.2**	1	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1458 by 302		Batch: S37754	
Zinc		**69.4**	2	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1458 by 302		Batch: S37754	
Dissolved Copper		**10.2**	1	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1455 by 302		Batch: S37754	
Dissolved Zinc		**69.6**	2	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1455 by 302		Batch: S37754	

AIC No. 184644-15
Sample Identification: Effluent-CD-109-Final

Analyte		Result	RL	Units	Qualifier
Copper		**16.1**	1	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1504 by 302		Batch: S37754	
Zinc		**102**	2	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1504 by 302		Batch: S37754	

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ANALYTICAL RESULTS

AIC No. 184644-15 (Continued)
Sample Identification: Effluent-CD-109-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Copper		**14.9**	1	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1501 by 302		Batch: S37754	
Dissolved Zinc		**101**	2	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1501 by 302		Batch: S37754	

AIC No. 184644-16
Sample Identification: Effluent-CD-168-Final

Analyte		Result	RL	Units	Qualifier
Copper		**24.7**	1	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1510 by 302		Batch: S37754	
Zinc		**147**	2	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1510 by 302		Batch: S37754	
Dissolved Copper		**23.2**	1	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1507 by 302		Batch: S37754	
Dissolved Zinc		**142**	2	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1507 by 302		Batch: S37754	

AIC No. 184644-17
Sample Identification: Effluent-CD-268-Final

Analyte		Result	RL	Units	Qualifier
Copper		**40.0**	1	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1516 by 302		Batch: S37754	
Zinc		**241**	2	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1516 by 302		Batch: S37754	
Dissolved Copper		**35.6**	1	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1513 by 302		Batch: S37754	
Dissolved Zinc		**228**	2	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1513 by 302		Batch: S37754	

AIC No. 184644-18
Sample Identification: Effluent-CD-403-Final

Analyte		Result	RL	Units	Qualifier
Copper		**56.7**	1	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1522 by 302		Batch: S37754	
Zinc		**361**	2	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1522 by 302		Batch: S37754	
Dissolved Copper		**49.8**	1	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1519 by 302		Batch: S37754	
Dissolved Zinc		**338**	2	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1519 by 302		Batch: S37754	

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ANALYTICAL RESULTS

AIC No. 184644-19
Sample Identification: Synthetic Adjusted MOD-CD-460-Final

Analyte		Result	RL	Units	Qualifier
Copper		**64.1**	1	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1534 by 302		Batch: S37754	
Zinc		**434**	2	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1534 by 302		Batch: S37754	
Dissolved Copper		**61.8**	1	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1531 by 302		Batch: S37754	
Dissolved Zinc		**427**	2	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1531 by 302		Batch: S37754	

AIC No. 184644-20
Sample Identification: Synthetic Adjusted MOD-CD-276-Final

Analyte		Result	RL	Units	Qualifier
Copper		**39.1**	1	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1540 by 302		Batch: S37754	
Zinc		**268**	2	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1540 by 302		Batch: S37754	
Dissolved Copper		**36.6**	1	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1537 by 302		Batch: S37754	
Dissolved Zinc		**264**	2	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1537 by 302		Batch: S37754	

AIC No. 184644-21
Sample Identification: Synthetic Adjusted MOD-CD-166-Final

Analyte		Result	RL	Units	Qualifier
Copper		**25.1**	1	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1545 by 302		Batch: S37754	
Zinc		**168**	2	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1545 by 302		Batch: S37754	
Dissolved Copper		**23.1**	1	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1543 by 302		Batch: S37754	
Dissolved Zinc		**163**	2	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1543 by 302		Batch: S37754	

AIC No. 184644-22
Sample Identification: Synthetic Adjusted MOD-CD-99.4-Final

Analyte		Result	RL	Units	Qualifier
Copper		**15.3**	1	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1551 by 302		Batch: S37754	
Zinc		**97.5**	2	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1551 by 302		Batch: S37754	

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ANALYTICAL RESULTS

AIC No. 184644-22 (Continued)
Sample Identification: Synthetic Adjusted MOD-CD-99.4-Final

Analyte		Result	RL	Units	Qualifier
Dissolved Copper		**13.7**	1	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1548 by 302		Batch: S37754	
Dissolved Zinc		**99.0**	2	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1548 by 302		Batch: S37754	

AIC No. 184644-23
Sample Identification: Synthetic Adjusted MOD-CD-59.6-Final

Analyte		Result	RL	Units	Qualifier
Copper		**10.5**	1	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1558 by 302		Batch: S37754	
Zinc		**59.0**	2	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1558 by 302		Batch: S37754	
Dissolved Copper		**9.51**	1	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1554 by 302		Batch: S37754	
Dissolved Zinc		**58.1**	2	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1554 by 302		Batch: S37754	

AIC No. 184644-24
Sample Identification: Synthetic Adjusted MOD-CD-35.8-Final

Analyte		Result	RL	Units	Qualifier
Copper		**8.12**	1	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1611 by 302		Batch: S37754	
Zinc		**39.8**	2	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1611 by 302		Batch: S37754	
Dissolved Copper		**7.34**	1	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1607 by 302		Batch: S37754	
Dissolved Zinc		**38.4**	2	**ug/l**	
EPA 200.7	Prep: 17-Nov-2014 1400 by 302	Analyzed: 17-Nov-2014 1607 by 302		Batch: S37754	

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DUPLICATE RESULTS

Analyte		AIC No.	Result	RPD	RPD Limit	Preparation Date	Analysis Date	Dil	Qual
Carbonaceous BOD 5-day		184608-1	< 2 mg/l			13Nov14 0819 by 302	18Nov14 0822 by 271		
	Batch: W49935	Duplicate	< 2 mg/l	0.00	20.0	13Nov14 0819 by 271	18Nov14 0823 by 271		
pH		184629-1	8.0 Units				13Nov14 1707 by 93		H
	Batch: W49946	Duplicate	8.0 Units	0.126	5.00		13Nov14 1724 by 93		H
Carbonaceous BOD 5-day		184658-1	3.0 mg/l			14Nov14 0818 by 271	19Nov14 0858 by 271		
	Batch: W49948	Duplicate	2.7 mg/l	8.76	20.0	14Nov14 1109 by 271	19Nov14 0900 by 271		
Alkalinity as CaCO3		184600-4	2800 mg/l				14Nov14 1100 by 93		
	Batch: W49951	Duplicate	2800 mg/l	1.07	20.0		14Nov14 1101 by 93		
Total Suspended Solids		184629-1	6.4 mg/l			17Nov14 0925 by 271	18Nov14 1115 by 271		
	Batch: W49970	Duplicate	6.0 mg/l	6.45	20.0	17Nov14 0925 by 271	18Nov14 1115 by 271		
Total Suspended Solids		184631-1	290 mg/l			17Nov14 0925 by 271	18Nov14 1115 by 271		
	Batch: W49970	Duplicate	290 mg/l	1.73	20.0	17Nov14 0925 by 271	18Nov14 1115 by 271		

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LABORATORY CONTROL SAMPLE RESULTS

Analyte	Spike Amount	%	Limits	RPD	Limit	Batch	Preparation Date	Analysis Date	Dil	Qual
pH	-	99.7	98.0-102			W49946		13Nov14 1724 by 93		
Ammonia as N	1 mg/l	94.8	80.0-120			W49976	17Nov14 1453 by 308	17Nov14 1549 by 308		
Carbonaceous BOD 5-day	200 mg/l	97.1	84.5-115			W49935	13Nov14 0819 by 271	18Nov14 0820 by 271		
Carbonaceous BOD 5-day	200 mg/l	101	84.5-115			W49948	14Nov14 1109 by 271	19Nov14 0857 by 271		
Total Organic Carbon	10 mg/l	94.2	80.0-120			W49961	14Nov14 1644 by 93	17Nov14 1524 by 93		
Copper	0.5 mg/l	99.8	85.0-115			S37746	13Nov14 1630 by 302	13Nov14 1638 by 302		
	0.5 mg/l	101	85.0-115	1.20	20.0	S37746	13Nov14 1630 by 302	13Nov14 1717 by 302		
Copper	0.5 mg/l	100	85.0-115			S37748	14Nov14 1300 by 302	14Nov14 1344 by 302		
	0.5 mg/l	100	85.0-115	0.199	20.0	S37748	14Nov14 1300 by 302	14Nov14 1430 by 302		
Copper	0.5 mg/l	102	85.0-115			S37754	17Nov14 1401 by 302	17Nov14 1434 by 302		
	0.5 mg/l	98.4	85.0-115	3.59	20.0	S37754	17Nov14 1401 by 302	17Nov14 1528 by 302		
Potassium	10 mg/l	106	85.0-115			S37746	13Nov14 1630 by 302	14Nov14 1254 by 302		
	10 mg/l	103	85.0-115	2.87	20.0	S37746	13Nov14 1630 by 302	14Nov14 1321 by 302		
Sodium	10 mg/l	108	85.0-115			S37746	13Nov14 1630 by 302	14Nov14 1254 by 302		
	10 mg/l	104	85.0-115	3.77	20.0	S37746	13Nov14 1630 by 302	14Nov14 1321 by 302		
Zinc	0.5 mg/l	96.8	85.0-115			S37746	13Nov14 1630 by 302	13Nov14 1638 by 302		
	0.5 mg/l	97.4	85.0-115	0.618	20.0	S37746	13Nov14 1630 by 302	13Nov14 1717 by 302		
Zinc	0.5 mg/l	96.0	85.0-115			S37748	14Nov14 1300 by 302	14Nov14 1344 by 302		
	0.5 mg/l	97.8	85.0-115	1.86	20.0	S37748	14Nov14 1300 by 302	14Nov14 1430 by 302		
Zinc	0.5 mg/l	98.2	85.0-115			S37754	17Nov14 1401 by 302	17Nov14 1434 by 302		
	0.5 mg/l	95.0	85.0-115	3.31	20.0	S37754	17Nov14 1401 by 302	17Nov14 1528 by 302		
Chloride	20 mg/l	102	90.0-110			C17241	14Nov14 1708 by 07	14Nov14 2219 by 07		
Sulfate	20 mg/l	106	90.0-110			C17241	14Nov14 1708 by 07	14Nov14 2219 by 07		
Total Recoverable Copper	0.5 mg/l	99.8	85.0-115			S37746	13Nov14 1630 by 302	13Nov14 1638 by 302		
	0.5 mg/l	101	85.0-115	1.20	20.0	S37746	13Nov14 1630 by 302	13Nov14 1717 by 302		
Total Recoverable Zinc	0.5 mg/l	96.8	85.0-115			S37746	13Nov14 1630 by 302	13Nov14 1638 by 302		
	0.5 mg/l	97.4	85.0-115	0.618	20.0	S37746	13Nov14 1630 by 302	13Nov14 1717 by 302		
Total Recoverable Zinc	0.5 mg/l	96.0	85.0-115			S37748	14Nov14 1300 by 302	14Nov14 1344 by 302		
	0.5 mg/l	97.8	85.0-115	1.86	20.0	S37748	14Nov14 1300 by 302	14Nov14 1430 by 302		

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MATRIX SPIKE SAMPLE RESULTS

Analyte	Sample	Spike Amount	%	Limits	Batch	Preparation Date	Analysis Date	Dil	Qual
Ammonia as N	184627-1	1 mg/l	97.7	80.0-120	W49976	17Nov14 1453 by 308	17Nov14 1553 by 308		
	184627-1	1 mg/l	96.2	80.0-120	W49976	17Nov14 1453 by 308	17Nov14 1555 by 308		
	Relative Percent Difference:		1.50	25.0	W49976				
Total Organic Carbon	184692-1	10 mg/l	98.7	80.0-120	W49961	14Nov14 1644 by 93	17Nov14 1601 by 93		
	184692-1	10 mg/l	95.8	80.0-120	W49961	14Nov14 1644 by 93	17Nov14 1619 by 93		
	Relative Percent Difference:		2.50	25.0	W49961				
Chloride	184708-1	20 mg/l	97.1	80.0-120	C17241	14Nov14 1708 by 07	14Nov14 2243 by 07		
	184708-1	20 mg/l	98.3	80.0-120	C17241	14Nov14 1708 by 07	14Nov14 2307 by 07		
	Relative Percent Difference:		1.11	10.0	C17241				
Sulfate	184708-1	20 mg/l	102	80.0-120	C17241	14Nov14 1708 by 07	14Nov14 2243 by 07		
	184708-1	20 mg/l	104	80.0-120	C17241	14Nov14 1708 by 07	14Nov14 2307 by 07		
	Relative Percent Difference:		1.40	10.0	C17241				

LABORATORY BLANK RESULTS

Analyte	Result	RL	PQL	QC Sample	Preparation Date	Analysis Date	Qual
Alkalinity as CaCO3	< 1 mg/l	1	1	W49951-1		14Nov14 1101 by 93	
Ammonia as N	< 0.1 mg/l	0.1	0.1	W49976-1	17Nov14 1453 by 308	17Nov14 1548 by 308	
Carbonaceous BOD 5-day	< 2 mg/l	2	2	W49935-1	13Nov14 0819 by 271	18Nov14 0819 by 271	
Carbonaceous BOD 5-day	< 2 mg/l	2	2	W49948-1	14Nov14 1109 by 271	19Nov14 0856 by 271	
Total Organic Carbon	< 1 mg/l	1	1	W49961-1	14Nov14 1644 by 93	17Nov14 1506 by 93	
Total Suspended Solids	< 4 mg/l	4	4	W49970-1	17Nov14 0925 by 271	18Nov14 1115 by 271	
Copper	< 0.001 mg/l	0.001	0.001	S37746-1	13Nov14 1630 by 302	13Nov14 1705 by 302	
Potassium	< 1 mg/l	1	1	S37746-1	13Nov14 1630 by 302	14Nov14 1308 by 302	
Sodium	< 1 mg/l	1	1	S37746-1	13Nov14 1630 by 302	14Nov14 1308 by 302	
Zinc	< 0.002 mg/l	0.002	0.002	S37746-1	13Nov14 1630 by 302	13Nov14 1705 by 302	
Copper	< 0.001 mg/l	0.001	0.001	S37748-1	14Nov14 1300 by 302	14Nov14 1341 by 302	
Zinc	< 0.002 mg/l	0.002	0.002	S37748-1	14Nov14 1300 by 302	14Nov14 1341 by 302	
Copper	< 0.001 mg/l	0.001	0.001	S37754-1	17Nov14 1401 by 302	17Nov14 1431 by 302	
Zinc	< 0.002 mg/l	0.002	0.002	S37754-1	17Nov14 1401 by 302	17Nov14 1431 by 302	
Chloride	< 0.2 mg/l	0.2	0.2	C17241-1	14Nov14 1708 by 07	14Nov14 2154 by 07	
Sulfate	< 0.2 mg/l	0.2	0.2	C17241-1	14Nov14 1708 by 07	14Nov14 2154 by 07	
Total Recoverable Copper	< 0.001 mg/l	0.001	0.001	S37746-1	13Nov14 1630 by 302	13Nov14 1705 by 302	
Total Recoverable Zinc	< 0.002 mg/l	0.002	0.002	S37746-1	13Nov14 1630 by 302	13Nov14 1705 by 302	
Total Recoverable Copper	< 0.001 mg/l	0.001	0.001	S37748-1	14Nov14 1300 by 302	14Nov14 1341 by 302	
Total Recoverable Zinc	< 0.002 mg/l	0.002	0.002	S37748-1	14Nov14 1300 by 302	14Nov14 1341 by 302	

AMERICAN INTERPLEX CORPORATION
LABORATORIES

1

CHAIN OF CUSTODY / ANALYSIS REQUEST FORM

Client: VAN BUREN MUNICIPAL UTILITIES
Project Reference: NORTH PLANT
Project Manager: CLYDE Hill
Sampled By: [signature]

PO No.:

AIC CONTROL NO: 184644
AIC PROPOSAL NO:
Carrier:
Received Temperature C: 0.2 C

AIC No.	Sample Identification	Date/Time Collected	GRAB	COMP	WATER	SOIL		NO OF BOTTLES	WER STUDY												Remarks
	NPE1	11/11-12/14 8:00-8:00A		X	X			3	X												pH 6.71/5°
																					Field pH calibration
		Container Type						P													on 11/12 @ 6:30
		Preservative						NO													Buffer: 4-7

G = Glass, NO = none, P = Plastic, S = Sulfuric acid pH2, V = VOA vials, N = Nitric acid pH2, H = HCl to pH2, B = NaOH to pH12, T = Sodium Thiosulfate, Z = Zinc acetate

Turnaround Time Requested: (Please circle)
NORMAL or EXPEDITED IN ____ DAYS
Expedited results requested by: ____
Who should AIC contact with questions: Clyde Hill
Phone: ____ Fax: 479-719-6608
Report Attention to: VBEned@aol.com
Report Address to:

Relinquished By: [signature]	Date/Time 11/12/14 10:45	Received By: FEDEX-E 7718 2786 8682	Date/Time 11/12/14 10:45
Relinquished By:	Date/Time	Received in Lab By: Troy williams	Date/Time 1:15 11-13-14

Comments: FedX 771827868682

FORM 0060